

Measuring workforce sustainability in school groups

Methodology discussion paper

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School Performance,
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1. Executive Summary

This is the third consultation paper as part of EPI's work to identify the features of effective school groups. The 'Opportunity for All 2022' white paper re-established the government's ambition that all schools in England should be part of a strong multi-academy trust, or be planning to join one, by 2030.¹ However, agreed metrics to measure what makes a strong academy trust (or other school group) have not yet been established. The dual purpose of EPI's Effective School Groups work is to develop a suite of measures that identify top-performing school groups and then explore the specific practices and features which enable that high performance. This will mean that the right school groups can be supported to expand and best practice can be disseminated across the school system.

This paper develops quantitative measures of sustainable workforce management, specifically turnover of classroom teachers. Our results are presented for feedback: a list of consultation question is presented at the end of the report, but we welcome feedback on any aspect of this work including whether there are dimensions beyond turnover that we could reasonably measure from administrative data sources.

Measuring turnover

We present measures of teacher turnover at a group-level, such that a teacher who moves between schools within the same academy trust (or other close school grouping) is regarded as retained. As these measures are still in development, we do not identify individual school groups at this stage.

We present two key measures of turnover:

- Annual turnover: the percentage of teachers exiting a school group each year. Specifically, we present a three-year rolling average for annual turnover between 2010 and 2019
- Five-year cumulative turnover: the percentage of teachers that have exited a school group five years after a baseline measurement is taken. We have data for 2010-2015 baseline years.

Having examined both we propose five-year cumulative turnover as our preferred measure. We make this decision because the cumulative measure is more amenable to interpretation and captures more holistically the disruption caused by high staff turnover. However, a key trade-off of that decision is that we have data for substantially fewer school groups and the data we have is biased towards more stable schools, as schools that have moved group within the past five years are not included.

We recognise the challenge of defining optimum turnover. Low teacher turnover has been described as "the ideal problem to have" but means that there are fewer opportunities to improve job matching between teachers and schools and, at a system level, may mean that particular school groups do not bear a proportionate load of the work of developing new teachers.² High teacher turnover has been shown to negatively impact student attainment and drains school resources.³ High turnover schools may also enter a vicious cycle in which high turnover leads to poor working

¹ Department for Education, 'Opportunity for All: Strong Schools with Great Teachers for Your Child'.

² Niblett and Andrews, 'People Power: Six Ways To Develop And Retain Educators In Multi-Academy Trusts'.

³ Gibbons, Scrutinio, and Telhaj, 'Teacher Turnover'.

conditions which leads to sustained high turnover. This paper shows that there are groups with significantly higher or lower turnover than average, without making a claim about whether higher or lower is desirable. In future we intend to link our retention metrics to pupil outcomes to explore this question further.

We find that a large number of the school groups for which we have data have cumulative turnover figures significantly different from average. Twenty-seven per cent of schools groups have turnover figures statistically above average, and 76 per cent of these are substantially higher. Thirty per cent of school groups have turnover significantly lower than average, of which 62 per cent are substantially below. This means 43 per cent of school groups have turnover figures that are about average. We can compare this with other performance measures, such as Progress 8, where 37 per cent of schools record broadly average performance.

Understanding variation

The large amount of variation in turnover figures means we are not yet able to confidently identify school groups where deliberate workforce management policies lead to higher or lower turnover, as opposed to other contextual factors. A key problem in taking this next step is determining what factors within school workforce should be considered as contextual and what arises from decisions taken by school groups. For example, turnover is observed to be higher for less-experienced teachers.⁴ We can control for this so that the effect of teacher experience is isolated and we can examine whether turnover is higher or lower than expected given how much experience teachers in a particular school group have. However, the recruitment of less-experienced teachers could be a contextual factor (in times of constricted supply school groups may have limited choice over who to employ and therefore little control over the experience levels of their staff) or a result of deliberate policies (some school groups may choose to preferentially employ newer teachers). In practice, there is likely a mix of these two effects happening across the school system at any one time. Controlling for experience may be considered fair to those groups that have no choice but to employ inexperienced staff, but it may equally mask the decision making of groups whose inexperienced staff arise from a result of their workforce management policies. Similar tensions arise for other factors known to affect staff turnover.

Given this, we seek further input from our education colleagues regarding the best way to approach this problem. We know many within the sector are reflecting on how to assess the performance of school groups. There is work going on within the Department for Education, universities and other research institutes with strong pedigrees in this field. Similarly, schools, academy trusts and others working on the front-line have valuable experience both in terms of what workforce management policies are applied on the ground and what measures are likely to be accepted as valid by the field.

Other measures

This initial consultation looks only at measures of teacher turnover. We recognise that a single metric is unlikely to capture the diversity of practice within workforce management. For example, EPI has previously looked at progression rates in different types of school.⁵ This work described in this document has enabled proof-of-principle linkage of school-level workforce data to group

⁴ Worth et al., 'Teacher Workforce Dynamics in England'.

⁵ Niblett and Andrews, 'People Power: Six Ways To Develop And Retain Educators In Multi-Academy Trusts'.

membership. In the future, this will enable us to investigate others workforce factors, such as the extent of flexible working, gender balance and pay. We also understand that in the future, MAT central staff may be recorded in the School Workforce Census, allowing the movement of teachers from schools into central functions to be accounted for.

Consultation responses

We encourage and welcome your feedback in order to improve these measures of workforce management within school groups. Please return your feedback to us via feedback@epi.org.uk. The closing date for emailing feedback is **Friday 6th January**. This feedback may refer to the consultation questions on page 48 or any other aspect of this work. Please include some details of which organisation you are representing with your views, for example a school or academy trust or an academic setting. Any additional questions can also be directed to the same email address.

2. Introduction

The recruitment and retention of teachers is a serious challenge for the English education system: recruitment targets are not being met, nearly a third of teachers leave the profession within five years of qualifying and schools with the most disadvantaged intakes face the greatest staffing difficulties.⁶

The recent Opportunity for All white paper announced the intention that by 2030, all English schools will be in a 'strong' multi-academy trust (or planning to join or form one).⁷ It argues that such strong trusts support the recruitment and retention of school staff through better working conditions and additional training and career pathways, leading to improved outcomes for pupils. The best trusts are also expected to deploy excellent teachers where they are needed most, alleviating pressure on the most disadvantaged schools.⁸

However, as identified in previous EPI research, there is wide variation in the performance of different academy trusts.⁹ To support strong trusts to expand we must first identify which trusts are strong. EPI has therefore launched a programme of work which aims to develop robust and credible measures to identify effective school groups. These metrics span four domains: pupil outcomes, workforce, financial efficiency, and pupil inclusion. This work commenced in 2020 and has so far published consultations on efficiency and inclusion and launched a longitudinal survey to better understand how different groups of schools work together.

This paper launches our consultation on how to measure successful school workforce management at a group level, and to identify high or low performing school groups. It builds on previous work by EPI looking at teacher supply in general, and workforce dynamics within academy trusts.¹⁰ We use data from the school workforce census to attempt to identify trusts that appear to have abnormally high staff turnover, which is understood as a strong proxy for poor working conditions.¹¹

As for our other measures of school-group effectiveness, we are publishing this paper as a consultation. Below, we outline the data and methods we have used, the decisions we have taken and the constraints they impose. We seek feedback from our colleagues in the sector about the robustness of these, and suggestions for improvement. The next steps, following consultation, will be to create finalised group-level workforce metrics, which can be linked to our metrics on inclusion, efficiency and pupil outcomes (once data is available in post-Covid assessments) to attempt to identify the strongest academy trusts.

⁶ Zuccollo, 'Teachers' Pay in Context'; Allen and McInerney, 'The Recruitment Gap'.

⁷ Department for Education, 'Opportunity for All: Strong Schools with Great Teachers for Your Child'.

⁸ Department for Education, 'The Case for a Fully Trust-Led System', March 2022, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1076862/The_case_for_a_fully_trust-led_system.pdf.

⁹ Andrews, 'Quantitative Analysis of the Characteristics and Performance of Multi-Academy Trusts'.

¹⁰ Fullard and Zuccollo, 'Local Pay and Teacher Retention in England'; Niblett and Andrews, 'People Power: Six Ways To Develop And Retain Educators In Multi-Academy Trusts'.

¹¹ Sims, 'TALIS 2013: Working Conditions, Teacher Job Satisfaction and Retention'.

3. Background

3.1 School groups

In the school system in England, there are multiple ways schools can work together. In September 2020, 1,400 multi-academy trusts (MATs) were operating, ranging in size from dual-school MATs educating a handful of pupils in specialist provision to system MATs with nearly 50,000 pupils in their schools.¹² Outside of academy trusts there are dioceses, federations, cooperative and foundation trusts and, finally, local authorities. A significant number of schools will move into new groups as a result of the push for full academisation. It is therefore imperative we understand best practice for collaborative work across schools so that it can be disseminated across the new trust-led system. This paper therefore looks at quality measures for workforce management across all types of school group, not just multi-academy trusts.

3.2 School workforce

In 2021, nearly 1 million full-time equivalent jobs were offered in the school system, of which 465,000 were teaching posts. In the same year 36,000 teachers left the state school workforce and 44,000 new teachers joined, of whom half were newly qualified teachers. This means that slightly under 5 per cent of the teaching workforce in 2021 were newly qualified teachers. Of the 36,000 teachers leaving the state-funded section in England, 88 per cent left to work elsewhere; the number of teachers leaving each year due to retirement has been decreasing since 2010/11. Since 2011, the overall number of teachers has not kept pace with increasing pupil numbers: the ratio of pupils to qualified teachers has increased from 17.6 in 2011 to 18.0 in 2021 and the number of teacher vacancies has risen.¹³

Looking at teacher movement across schools, rather than out of the profession, in 2018 the National Foundation for Education Research (NFER) found that between 2010 and 2016 the rate of teachers moving schools increased more rapidly than the rate of teachers leaving the school workforce. In 2016, 8.5 per cent of primary teachers and 8.3 per cent of secondary teachers moved school in any given year, up from 5.3 and 4.2 per cent in 2010.¹⁴ While most concern over teacher recruitment and retention takes a system perspective (seeking to ensuring sufficient teacher supply to meet the overall needs of the education sector), movement within the sector has implications for schools and therefore pupils.

Any assessment of teacher turnover can only tell a partial picture of workforce management within schools and trusts, not least because around half of those employed in schools are not teachers. Around 3 in 10 of the school workforce are teaching assistants and the remaining 2 in 10 are support staff more broadly.¹⁵ In this paper we report our headline turnover figures for classroom teachers only. However, the School Workforce Census also contains employment records for other staff groups. Our consultation questions ask if and how turnover figures for these staff groups should be included. If we are interested in the workforce management practices of a particular school group

¹² Number of multi-academy trusts derived from DfE data by EPI, as detailed below.

¹³ Department for Education, 'School Workforce in England: Reporting Year 2021'.

¹⁴ Worth et al., 'Teacher Workforce Dynamics in England'.

¹⁵ Department for Education, 'School Workforce in England: Reporting Year 2021'.

does that extend to the complete workforce, such that we should report a combined overall turnover for all staff groups? Or are there reasons to be particularly interested in teacher turnover? For example, school (groups) may have less discretion over the number of teaching staff they employ, the impact of teacher quality on student outcomes is more solidly evidenced and the regulated qualification requirements for teachers mean that they might more readily be considered a distinct employment group.¹⁶

3.3 Factors affecting teacher turnover

Staff turnover occurs as a result of the decisions of individual staff members, located within different schools and school groups. Most research into staff turnover in schools has looked specifically at teacher turnover and a number of individual and institutional factors have been shown to affect the likelihood of a teacher choosing to change school or profession.

3.4 Individual factors

In their recent review of English teacher workforce dynamics, the National Foundation for Educational Research (NFER) found that teacher-level factors were of most predictive value, explaining 95 per cent of the variation in the probability of a teacher leaving the profession and 55 per cent of the variation in the probability of changing school. Two factors were found to have particular importance:

- a teacher's age and years of experience, which were jointly the most important predictor of leaving the profession or moving school
- subject taught, which had a small but statistically significant predictive effect, particularly on the likelihood of moving schools. Maths, science and modern foreign language (MFL) teachers had above-average rates of leaving the profession, whereas humanities teachers were the least likely to leave.

The oldest and youngest teachers were most likely to leave the profession, while the probability of moving school was highest for young teachers and decreased with age. The age profile of the teaching profession has shifted over time. Compared to 2010 there are now fewer teachers over 50, and over the same time period, the proportion of primary teachers who are younger than 30 and proportion of secondary teachers in their 30s and early 40s have increased. NFER examined whether changes in the rate of teacher turnover could be explained by these changes in the age of the teaching population, but found controlling for the age actually increased their estimates of how much turnover had increased.¹⁷

Other individual-level factors linked to turnover include working pattern (part-time vs full-time), role (classroom teacher vs senior leader) and ethnicity (ethnic minority teachers have a higher turnover rate).¹⁸

¹⁶ Luxton, 'EEF Blog: The Impact of Teaching Assistants – A Holistic Picture'.

¹⁷ Worth et al., 'Teacher Workforce Dynamics in England'.

¹⁸ Worth et al.; Allen, Burgess, and Mayo, 'The Teacher Labour Market, Teacher Turnover and Disadvantaged Schools'.

3.5 School factors

In addition to individual factors, a number of school-level characteristics have also been linked to differential rates of teacher turnover.

Turnover is typically higher for secondary teachers, compared to those employed in primary schools. Turnover is higher for schools located in London, even when compared to other large cities. Schools located in London tend to attract younger teachers but lose those in their 30s and 40s so the school workforce in London is younger than elsewhere.¹⁹ However, new teachers in London are more likely to leave the profession: five years after graduating, 39 per cent of new teachers who began in London had quit the profession compared to 29 per cent for the rest of England.²⁰

Schools which educate more pupils from disadvantaged backgrounds have higher levels of teacher turnover.²¹ However, the extent to which this is causative is disputed. One study found that much of the variation between schools in more and less disadvantaged neighbourhoods could be explained by school, pupil and local teacher labour market characteristics, and by the fact that these schools, on average, employ younger teachers. However, there was indication that pupil deprivation may be important as schools were found to have higher turnover if the fraction of their students eligible for FSM was higher than nearby competitors in the teacher labour market.²²

Other work has suggested that relationships between pupil demographics and retention are “largely spurious” and that pupil demographics may instead serve as a proxy for school working conditions.²³ A similar relationship may explain why schools with lower Ofsted grades experience higher-turnover.²⁴ Data from the TALIS survey found that once working conditions had been controlled for, neither the disadvantage of a school’s intake nor its Ofsted grade were found to have significant negative effects on teachers’ desire to leave their school.²⁵ This finding is supported by qualitative work which found that workload and working conditions were key factors behind teachers leaving the profession.²⁶

The most important components of working conditions were found to be the quality of leadership and teacher cooperation. High workload itself was not predictive of a desire to leave the profession once other working-conditions characteristics were controlled for, but job satisfaction was linked to teachers’ assessment of whether their workload is manageable.²⁷ Discrete choice experiments have found that teachers would be willing to trade-off higher pay/rewards to work in supportive environments with fewer challenges from pupil behaviour.²⁸

¹⁹ Worth et al., ‘Teacher Workforce Dynamics in England’.

²⁰ Fletcher-Wood and Zuccollo, ‘The Effects of High-Quality Professional Development on Teachers and Students: A Rapid Review and Meta-Analysis’.

²¹ Faulkner-Ellis and Worth, ‘Comparative Analysis of Teacher Attrition Rates in England and Wales’.

²² Allen, Burgess, and Mayo, ‘The Teacher Labour Market, Teacher Turnover and Disadvantaged Schools’.

²³ Sims and Allen, ‘Identifying Schools With High Usage and High Loss of Newly Qualified Teachers’.

²⁴ Worth et al., ‘Teacher Workforce Dynamics in England’.

²⁵ Sims, ‘TALIS 2013: Working Conditions, Teacher Job Satisfaction and Retention’.

²⁶ Department for Education, ‘Factors Affecting Teacher Retention: Qualitative Investigation’.

²⁷ Sims, ‘TALIS 2013: Working Conditions, Teacher Job Satisfaction and Retention’.

²⁸ Burge, Lu, and Phillips, ‘Understanding Teacher Retention’.

3.6 Group-level factors

There is some evidence that workforce dynamics are different in multi-academy trusts compared to other school groups. NFER found that MATs had a slightly-above average rate of teachers leaving the profession, although suggested this could be due to staff moving to MAT central office functions. For movement across schools, rather than out of the profession, they found teachers moved school more in MATs and this was more pronounced for bigger academy chains. However, once moves within the same MAT were excluded there was no difference between MATs and other school types. Teachers in MATs may therefore be more mobile at a school level but no more likely to move when school group is the chosen unit of analysis.²⁹ Movement across school but within MAT could negatively affect pupils as they still experience a change in staffing. However, movements within MATs may be less disruptive than typical as schools in the same group may have more similar ethos' and practices.³⁰ NFER found that when teachers within a MAT do move school they are substantially more likely to move to a school in the same chain than any other similarly-close school. This might be due to MAT policies to encourage within-trust movement or teachers within a MAT not wishing to change employer. NFER also found that teachers moving within a MAT were more likely to move to a school with a more disadvantaged intake, reversing the general trend for teachers to move away from such schools. Workforce dynamics within MATs may therefore help ensure the most experienced teachers are available to the most disadvantaged pupils.

"The Case for a Fully Trust-Led System", a supporting document published alongside the 2022 white paper sets out the argument for better workforce management in strong multi-academy trusts.³¹ It argues that strong academy trusts improve teacher quality (and therefore educational outcomes) by providing high-quality training and development opportunities. Workload is a key concern for school staff and larger trusts are seen as able to mitigate this through measures such as the provision of shared teaching and learning resources and streamlined back-office functions. Larger trusts are also seen to also offer additional career progression pathways, as highlighted by the Ambition Institute report discussed below, which shows teachers in academy schools are promoted earlier than elsewhere. From an efficiency perspective, larger trusts may be able to flexibly use existing staff to cover sickness or parental leave and therefore avoid paying for more-expensive agency and supply staff and centrally co-ordinated recruitment may reduce overheads.

In 2019 Ambition Institute and EPI published a review of how multi-academy trusts could develop and retain their teaching staff.³² Similarly to NFER, the research found that academies (particularly those in larger trusts) have higher teacher turnover and higher proportions of new entrants. This effect remains after taking account of disadvantage and performance of schools in larger trusts, as well as changes that happen after taking on a new school. Higher rates of school movement and exit from the state-sector were found, despite MATs having higher promotion rates and promoting teachers at younger ages than other schools. The theoretical benefits of multi-academy trusts for workforce management do not yet seem to have resulted in a more stable workforce. Identifying school groups with particularly high or low turnover may therefore be helpful to uncover and disseminate best practice.

²⁹ Worth et al., 'Teacher Workforce Dynamics in England'.

³⁰ Greany, 'Sustainable Improvement in Multi-School Groups'.

³¹ Department for Education, 'The Case for a Fully Trust-Led System'.

³² Niblett and Andrews, 'People Power: Six Ways To Develop And Retain Educators In Multi-Academy Trusts'.

3.7 Defining ‘good’ teacher turnover

A key problem in developing a metric to measure performance using staff turnover is that both high and low turnover can create issues. Described in work by the Ambition Institute as “the ideal problem to have”, low staff turnover may limit opportunities for progression and lead to higher wage bills at a school level.³³ This may not be problematic where a school or group deliberately chooses to invest in experienced staff but, given that school and group leaders have little power to force teachers to move on, a high wage bill may ‘bind the hands’ of school groups who would prefer to spend in other areas. Turnover is also essential to resolve poor job matching, where an individual teacher is a poor fit either for a particular school (group) or the profession more generally. Evidence from the USA shows that less effective teachers are more likely to leave the profession and in the UK less-experienced (and so typically lower-quality) teachers are more likely to change profession or change school.³⁴ Low turnover that results in the retention of low-quality-teachers or restricts opportunities for teachers to move to schools that are a better match for their skills and experience may therefore suppress overall teacher-quality. At a system-level, individual school (groups) with very low turnover and therefore a low share of new and inexperienced teachers might be seen as not contributing equitably to the training requirements of the wider workforce.

Some staff turnover is therefore necessary and desirable, but excessively high turnover has been found to have negative effects on student attainment. A one standard-deviation increase in annual teacher entry rate results in a 0.8 per cent of a standard deviation reduction in GCSE scores, with students in the middle of the ability distribution most negatively affected.³⁵ There are several potential mechanisms through which high turnover could impact pupil attainment. Recruiting new staff costs time and money and therefore has a direct impact on the resource available to high-turnover schools. The average cost to replace a teacher has been estimated at £4,600, equivalent to the annual pupil premium funding for 3 or 4 pupils eligible for free school meals.³⁶ During times of teacher shortage, it can be difficult to replace an experienced or effective teacher with a similarly-skilled individual, so school leaders may either use more temporary teachers or lower recruitment standards.³⁷ Even where like-for-like replacement is possible, high turnover is institutionally disruptive. For individuals, high turnover means fewer staff-to-staff and staff-to-pupil social ties and the loss of institutional knowledge, which may impair organisational functioning and student achievement.³⁸ This lack of school-specific human capital has been found a key contributor to the negative effects of high-turnover.³⁹

The previous section highlighted the crucial role of working conditions, including strong leadership and collaboration between teachers, in retaining teachers. Since high staff turnover may weaken leadership capacity and sever social ties, there is a risk that high turnover and poor working

³³ Niblett and Andrews.

³⁴ Boyd et al., ‘Who Leaves? Teacher Attrition and Student Achievement’; Sims and Allen, ‘Identifying Schools With High Usage and High Loss of Newly Qualified Teachers’.

³⁵ Gibbons, Scrutinio, and Telhaj, ‘Teacher Turnover’.

³⁶ PWC, ‘Feeling the Squeeze: Schools’ Response to Constraints in Teacher Recruitment’.

³⁷ Sims, ‘TALIS 2013: Working Conditions, Teacher Job Satisfaction and Retention’; Sorensen and Ladd, ‘The Hidden Costs of Teacher Turnover’; Hanushek, Rivkin, and Schiman, ‘Dynamic Effects of Teacher Turnover on the Quality of Instruction’.

³⁸ Holme et al., ‘Rethinking Teacher Turnover’.

³⁹ Gibbons, Scrutinio, and Telhaj, ‘Teacher Turnover’.

conditions become mutually re-enforcing, such that a two-tier system forms whereby one set of school (groups) secures good working conditions and low turnover while the other suffers from chronically high turnover, poor working conditions and poor pupil outcomes. Since evidence suggests that schools serving the most disadvantaged pupils currently have the greatest staffing difficulties, this could exacerbate existing educational inequalities.⁴⁰ Given the importance of working conditions for turnover, excessively high turnover rates may be a legitimate indicator of problems elsewhere in the school (group).

Given this, we propose that staff turnover is a useful metric by which to identify school groups that perform well on workforce management. In particular, unusually high levels of turnover may serve as an indicator of problematic working conditions within that school group. However, a key challenge is how to disentangle group-level effects from the school and individual-level effects described above and how to identify where high or low turnover is the effects of deliberate policy decisions compared to the broader context in which school groups operate. Below, we outline the methods we have trialled and the challenges we still face.

⁴⁰ Allen and McNerney, 'The Recruitment Gap'.

4. Data and methods

This project involved bringing together two datasets: workforce data from the School Workforce Census and historical records of school group membership and school characteristics, hosted on the Department for Education's 'Get Information About Schools' platform.

4.1 Employment records

Our employment data is drawn from the School Workforce Census (SWC). This records role, salary, qualifications, and personal characteristics of all staff working in English schools, as captured by the Department for Education in November each year. In 2020, the census had a 99.8 per cent return rate. It is a longitudinal dataset from which we use data from 2010-2020. This allows us to track 9 years of staff movement between schools and into and out of the English state school workforce (we cannot track movement during 2020 until data for 2021 is published). Note that only formal arrangements are recorded in the SWC; a teacher with two separate contracts in two separate schools will have two records, but we are not able to identify cases where a member of staff is employed by one school but deployed elsewhere, for example a teacher working in multiple schools across a federation or seconded to a different school within a MAT.

We start data cleaning by allowing staff to have only one contract in any given academic year. Where staff have multiple contracts in a given year, we retain only the contract with the latest end date or, in the case of a tie, the contract with the longest duration.

Next, we simplified role types. Classroom teachers may have a variety of roles within the SWC, reflecting their skills and experience. Analysis at a more granular level would enable us to say more about differential turnover for staff at different stages of their career, but the number of staff employed in some role types is small and some roles have now been abolished. Aggregating roles into larger groups allows us to derive more reliable estimates of turnover and to treat staff with fundamentally-similar organisational functions as a common pool. A summary of how roles are re-allocated under our simplified designations is provided in Figure 4.1.1. We also calculated turnover figures for support staff and teaching assistants, who are designated as such in the SWC. For simplicity, in this preliminary work we only report outputs for classroom teachers. Once we have finalised our approach, we may extend to other staff groups.

Figure 4.1.1: List of simplified role descriptors used

Simplified role	Original role recorded in SWC
Classroom teacher	Classroom teacher Classroom teacher, upper pay range Classroom teacher, main pay range Leading Practitioner Apprentice Teacher Advisory Teacher Advanced Skills Teacher Excellent Teacher
Leaders	Executive Head Teacher Head Teacher Deputy Head Teacher

	Assistant Head Teacher
Heads	Executive Head Teacher Head Teacher
Support staff	As defined in SWC
Teaching assistants	As defined in SWC

The cleaned and simplified SWC data is now ready to be joined to our timeseries of school group membership.

4.2 Group membership information

The SWC links school staff to individual schools. To locate these schools within groups we appended information from Get Information About Schools (GIAS), a Department for Education database that contains historical records of school group membership and is available for public download.⁴¹ Schools were allocated to a particular group for each year throughout the timeseries 2010 to 2020. We designated 10 different school group types, outlined in Figure 4.2.1. Multi-academy trusts were subdivided into those with an association with a diocese and then on size, following the classification originally proposed by the National Schools' Commissioner and used in previous EPI research on multi-academy trusts.⁴² Size classifications were based on the number of pupils present in a group in September 2021 and do not vary over time. This means that a group is marked as e.g. a system trust for SWC data collected in 2011 if it had reached that size by 2021, even if the trust was significantly smaller in 2011. We took this approach because our focus was to identify the strongest examples of individual groups that are currently operating in the school system today. We therefore identified a group's current size and applied this for simplicity and constancy throughout the timeseries-. In doing this we have chosen to maximise the amount of information we have about turnover in a particular group rather than in a particular size of group. However, for this reason, only the most recent data is used to examine differences between MATs of different sizes and our ability to draw conclusions on this topic is limited. Future work may look at dynamically assigning trusts to size groups.

A school which moves out of one group and into another (e.g. an LA school academising or an academy re-brokerage) is associated with their new group from the beginning of the next academic year. However, as described below, schools must be members of their group for at least two years before their turnover contributes to our group-level calculations. This fits with Ofsted's policy of not inspecting 'new schools' (including academy converters and re-brokered academies) until their third year of operation.⁴³ Furthermore, teachers staying in a school which changes group membership are recorded as retained by linking their predecessor institution with its successor. Otherwise schools which changed group would record a 100 per cent turnover rate.

⁴¹ Department for Education, 'Get Information about Schools: Downloads'.

⁴² Andrews, 'Quantitative Analysis of the Characteristics and Performance of Multi-Academy Trusts'.

⁴³ Ofsted, 'Guidance: Selecting New Schools and Schools That Undergo Significant Change for Inspection'.

Figure 4.2.1: List of school group types

Group-type	Definition	Number in dataset
LA	A maintained school with no other recorded group affiliation.	156
Diocese	A maintained school recorded as being part of a Diocese	65
Federation	A maintained school recorded as being part of a Federation	463
Foundation Trust	A maintained school recorded as being part of a Trust. These are different to academy trusts, and are often cooperatives or learning partnerships supported by a charitable foundation	221
SAT	A school recorded as a Single Academy Trust	1850
Diocesan MAT	A school in MAT where more than 60 per cent of member schools are affiliated with a diocese	236
Starter MAT	A school in an MAT with fewer than 1,200 pupils	471
Established MAT	A school in an MAT with 1,200-5,000 pupils	570
National MAT	A school in an MAT with 5,001 – 12,000 pupils	103
System MAT	A school in an MAT with more than 12,000 pupils.	22

4.3 Turnover calculations

Once individual schools have been allocated to groups, we are able to calculate our group-level measures of teacher turnover.

The first step is to calculate staff exits. Each year the SWC records which individuals (identified by a unique ID) are employed by which schools (identified by unique reference number, or URN). We compare an individual's record in year n with their record in year $n+1$. An individual is deemed to have exited a school if they:

- no longer appear in the SWC and therefore are no longer recorded as working in the state sector in England
- appear in the SWC but employed by an institution that has a different URN to their previous school **and** the new URN is not considered a direct successor for their previous school (e.g. where a school academises and is given a new URN)

If a school changes URN (for example, by converting from an LA school to an academy) the predecessor URN is linked to the new school URN so staff are not counted as having moved to a new establishment. Where there is more than one predecessor in a given year (i.e. multiple schools merge), a single predecessor school is chosen based on the order that they appear in the establishment list obtained via Get Information About Schools. This means that where two schools merge the historical records for one school are discarded.

To determine whether a staff member has exited a school group requires an additional level of decision-making.

- Any movement out of a SAT is considered an exit.
- For schools whose only group affiliation is a local authority or a Diocese, any movement to a new school is an exit, even if they have moved to another school within the same LA or Diocese.
- For all other group types, movement only counts as an exit when an individual either leaves the SWC or moves to a new institution which is not part of the same group.

These rules are summarised in Figure 4.3.1

Figure 4.3.1: Rules for calculating teacher exits from school groups

		Moves to another school in the same group	Moves to another school in a different group	Leaves the SWC
Group Type	SAT	N/A	Exit	Exit
	LA or Diocese	Exit	Exit	Exit
	Any other group	Not an exit	Exit	Exit

We apply different rules across different school groups to reflect the extent to which governance arrangements affect where decisions around appointments are taken. For example, in maintained schools it is the governing body (or their delegates) rather than the local authority that makes staffing decisions, even though the local authority is the employer. We welcome reflections on our approach as part of this consultation.

Adopting different definitions of what constitute an exit from a school group clearly has impacts on the calculated turnover rate. Applying a more ‘generous’ definition of an exit to some school group types could be seen as (artificially) suppressing turnover metrics for those group types. Determining the correct approach to this question is a challenge of working with data from a heterogeneous school system; ties between schools in some school groups are believed to be weak whereas the ties between institutions in other school group types are understood to be stronger. Reviewing our final turnover outputs, LA and Diocese groups are found to have comparatively low turnover rates, suggesting they have not been unduly penalised by this decision.

In this work, we do not differentiate between staff moving school and those leaving the state system. At an organisational level (either school or school group) the effect of a staff member

leaving is the same regardless of their destination. However, we recognise that at a system-level employment conditions that lead to a large number of staff exiting the state sector are more problematic than those which simply lead to a lot of movement within the sector. We may extend our analysis to take account of teacher movement between schools compared to teacher exit from the state sector in the future.

Once we have identified movements out of a school, we can then calculate the turnover at a group level. We do this by comparing the total number of staff in a school group with the total number of staff exits from that group, using the two methods described below. We exclude from our analysis groups which are not single-academy trusts that have only one school in a given year. This mostly affects foundation trusts which sometimes run a single school, and trusts registered as MATs which nevertheless only have one school. All single-academy trusts are retained in the analysis

We calculate two key measures of turnover, annual and cumulative, following the suggestion of Holme and colleagues at the University of Texas.⁴⁴ Annual turnover indicates how many staff leave in a typical year, whereas cumulative turnover gives an idea of instability over the longer term. More detail is provided below.

Annual turnover: the number of teachers 'exiting' a group in year n, as a percentage of the total number of teachers in the group the prior year (n – 1). To minimise the effect of random variation, we report this as a rolling retrospective three-year average,

Figure 4.3.2: Worked example of an annual turnover calculation

	2016		2017		2018		2019	
	#Teachers	#Exits	#Teachers	#Exits	#Teachers	#Exits	#Teachers	#Exits
School A	10	1	10	2	10	1	10	3
School B	8	2	8	0	NA	NA	8	0
School C					15	2	15	3
2018 calculation:								
Rolling three-year period includes 2016, 2017 and 2018.								
Schools A and B are eligible as they have been group members for two years								
School A has 30 employment records and 4 exits								
School B has 16 employment records and 2 exits								
Average turnover = $(2+4)/(30+16) = 0.130$								
2019 calculation:								
Rolling three-year period includes 2017, 2018 and 2019.								
Schools A, B and C are eligible as they have been group members for two years								
School A has 30 employment records and 6 exits								
School B has 16 employment records and 0 exits								
School C has 30 employment records and 5 exits								
Average turnover = $(6+0+5)/(30+16+30) = 0.145$								

⁴⁴ Holme et al., 'Rethinking Teacher Turnover'.

We use the following rules to guide this calculation:

- A school must have been a member of a school group for at least two years before it contributes data to the group-level turnover metric
- For each year, we sum the total number of staff employed in eligible schools (those meeting the two year rule) and the total number of exits from those schools
- To create our rolling three-year average, we sum the number of exits by eligible staff in the year of interest and the preceding two years. We also sum the number of eligible staff employed by the group over the same period. We then divide the number of exits by the number of staff to create our rolling three-year average
- Where a school has missing data, it is excluded from the calculations and does not contribute either to the sum of staff employed or the sum of staff exiting
- Suppression rules to prevent identifying data from the SWC being published mean that we only extract turnover figures where a minimum of 10 staff are recorded as employed in a school group over the three-year period, and when reporting results by staff number all figures are rounded to the nearest 5.

A worked example is provided in Figure 4.3.2

Cumulative turnover: The proportion of staff present in a school group in year n , who are not present in year $n+x$. When calculating five-year cumulative turnover $x=5$, such that if our baseline year is 2010, we look to see what proportion of staff are no longer present in 2015. Throughout this report we use five-year cumulative turnover as our default. A limitation of this measure is that we check only the first and last year, not the intermediate years. Cases where a teacher is present in the first year and leaves for some intermediate years but returns in or before the 5th year will not be flagged as an exit.

We apply the following rules when calculating cumulative turnover:

- A school must have been part of the group for at least two years before the baseline year
- A school must then be present in the group for all 5 following years
- A group (except a SAT) must have at least two schools meeting this criteria in order to be included
- Suppression rules mean we only extract turnover figures where a minimum of 10 staff are recorded as employed in a school group over the five-year period. When reporting results by staff number all figures are rounded to the nearest 5.

The two measures, annual and cumulative turnover, highlight different but complementary aspects of teacher turnover. Two individual schools may both have average annual turnover of 20 per cent but if it is the same posts that are vacated and refilled each year (for example, posts occupied and re-filled by new and recently qualified teachers) then the school may retain up to 80 per cent of its staff on the cumulative measure. On the other hand, a school where the likelihood of leaving is equally distributed across posts could have the same annual turnover (20 per cent) but experience complete staff replacement during the 5-year period. The difference between these two measures is shown graphically in Figure 4.3.3. There are likely to be different conditions in our two hypothetical

school (groups) that lead to differences across these two measures such that we believe they both make a valuable contribution to understanding workforce dynamics in school.

Figure 4.3.3: Pictorial illustration of difference between annual and cumulative turnover

	School A Annual turnover: 0.2 Cumulative turnover: 0.2	School B Annual turnover: 0.2 Cumulative turnover: 1.0
Year 0 	 	 
Year 1 	 	 
Year 2 	 	 
Year 3 	 	 
Year 4 	 	 
Year 5 	 	 

The next section provides a summary of the data we are able to utilise in our calculation, before presenting our results.

4.4 Data summary

Figure 4.4.1 shows how many records of teacher employment we are able to utilise in our calculations.

De-duplication removes only a small number of records (0.1-0.2per cent) indicating few teachers have contracts in more than one school in any single year.

Our group data is less successful at matching schools in earlier years. We believe this arises as our method removes some predecessors: where a school has more than one predecessor only one is selected. This means some schools are not included in our group database to be matched.

Our methods for both annual and cumulative turnover cause us to lose significant numbers of teachers. This arises because of our rules for including schools in groups. For annual turnover, we filter to schools that are part of their group for at least two years and to groups with at least two schools meeting this requirement in each year. There are fewer groups meeting these criteria in earlier years, hence we lose more data in those years

For cumulative turnover, we have the same requirements as for annual turnover but also require schools to remain in the group for the full five-year period. The substantial turbulence in the school system over the past ten years, during which many schools have academised, federated or rebrokered means that in some years we lose data for up to 50 per cent of schools.

Figure 4.4.1: Summary of how many individual teacher records of employment are incorporated in each stage of our analysis

	Raw data	Duplicates removed	Matched to group data	Annual turnover figures	Cumulative turnover (baseline year)
2010	418,650	417,900 (99.8%)	391,050 (93.4%)	-	219,450 (52.4%)
2011	413,100	412,350 (99.8%)	391,050 (94.7%)	226,350 (54.8%)	208,950 (50.6%)
2012	422,800	422,000 (99.8%)	404,850 (95.8%)	325,200 (76.9%)	207,950 (49.2%)
2013	425,350	424,650 (99.8%)	412,250 (96.9%)	311,100 (73.1%)	233,750 (55%)
2014	430,900	430,100 (99.8%)	420,400 (97.6)	321,400 (74.6%)	250,250 (58.1%)
2015	430,650	429,900 (99.8%)	422,150 (98%)	338,400 (78.6%)	263,300 (61.1%)
2016	430,900	430,100 (99.8%)	423,950 (98.4%)	347,450 (80.6%)	-
2017	426,800	426,150 (99.8%)	421,750 (98.8%)	347,200 (81.4%)	-
2018	426,800	426,050 (99.8%)	421,850 (98.8%)	347,000 (81.3%)	-
2019	429,050	428,300 (99.8%)	424,650 (99%)	352,650 (82.2%)	-
2020	435,950	435,550 (99.9%)	431,950 (99.1%)	-	-

5. Results

5.1 Annual turnover

In our raw output of annual turnover (averaged over three years) we have 17,020 data points, representing 3,394 unique school groups. The breakdown of school group types per year is presented in Figure 5.1.1. As would be expected, SATs contribute the largest number of data points.

Figure 5.1.1: Data summary for annual turnover

Group Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Sum
Starter Trust	0	0	2	7	21	42	74	96	147	198	587
Established Trust	2	3	11	25	76	129	205	252	363	468	1534
National Trust	2	4	8	18	41	59	76	88	97	103	496
System Trust	5	8	12	15	18	21	21	21	22	22	165
Diocesan MAT	0	0	1	5	19	51	90	116	141	171	594
Diocese	64	63	61	60	59	59	59	59	58	58	600
Federation	31	59	81	111	157	191	223	259	293	330	1735
Foundation Trust	4	14	21	23	36	49	55	56	58	65	381
Local Authority	152	152	152	152	152	152	150	149	148	148	1507
SAT	34	48	170	778	1205	1430	1526	1481	1408	1341	9421
Sum	294	351	519	1194	1784	2183	2479	2577	2735	2904	17020

Figures 5.1.2a-d show the distribution of values for the average annual turnover measure for classroom teachers for various data groupings. We can see both for all data and for just MAT group types the 2019 average is lower than the average when all years of data are included. This may be an effect of the Covid pandemic, which started in March 2020.⁴⁵

We can see that the distribution of annual turnover values is positively skewed with a long tail of groups that have high turnover values. The distribution is also truncated as no group can have a negative turnover value. Particularly in graphs a and b (which include all group types) there is a small upwards tick in the distribution for groups with zero turnover. This is less pronounced when looking only at MATs. The 'all group types' data includes SATs which typically have smaller staff numbers than groups with multiple schools and therefore might be expected to show more variability.

Figures 5.1.3 and 5.1.4 show how the results for individual trusts are distributed, for MAT groups only. The results are presented as a swarm plot. In a swarm plot individual data points for each group are allowed to jitter, or spread, across the x-axis so that two points with the same y value are plotted alongside, rather than on top of each other. The degree of spread for each group is set as the normalized density of points, such that when there are a lot of data points with the same y value this is represented by a wider spread across the x axis. In this way, swarm plots show the number of data points, the density distribution, outliers and spread on a single plot.

⁴⁵ Zuccollo, 'Teacher Recruitment and Retention in the Eye of the Pandemic'.

Figure 5.1.2: Distribution of values, annual turnover (averaged over three years), classroom teachers

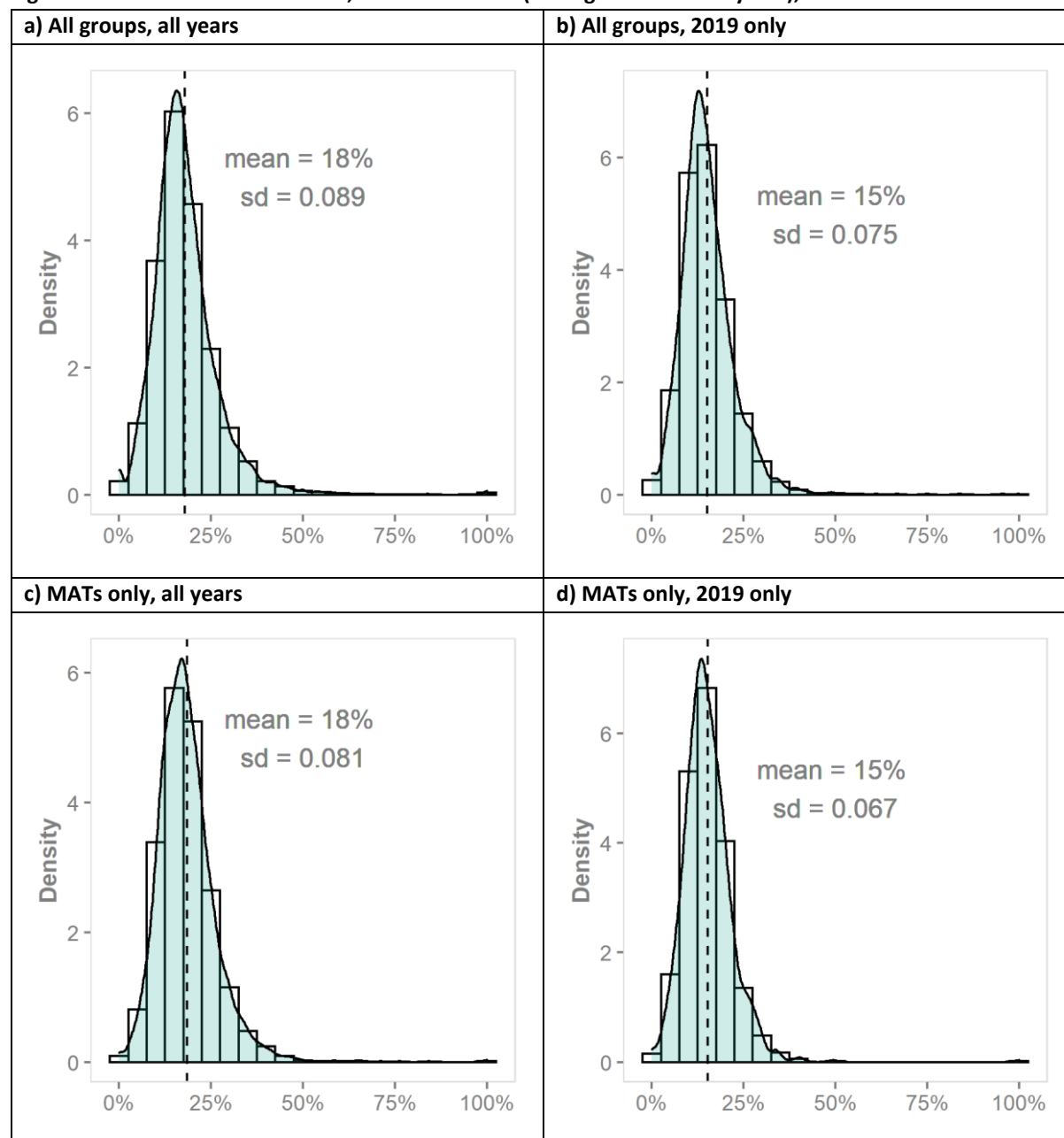


Figure 5.1.3: Swarm plot of annual turnover (three-year average) for MAT groups, all years

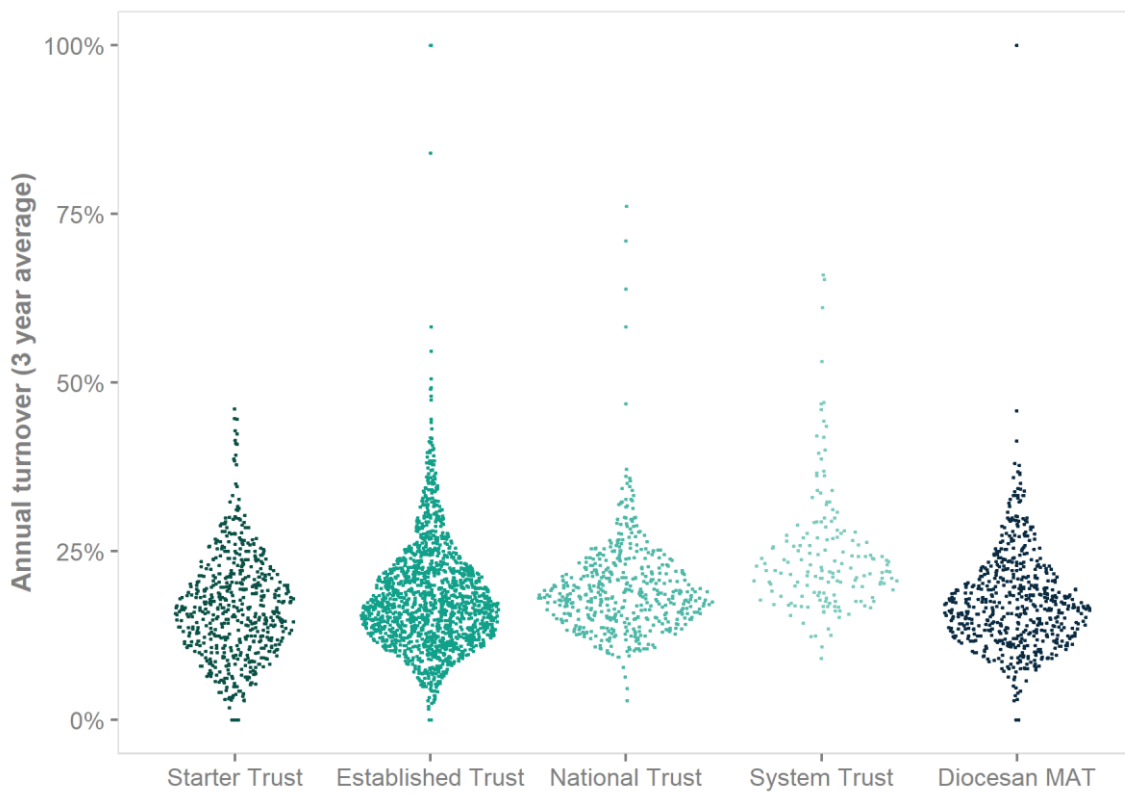
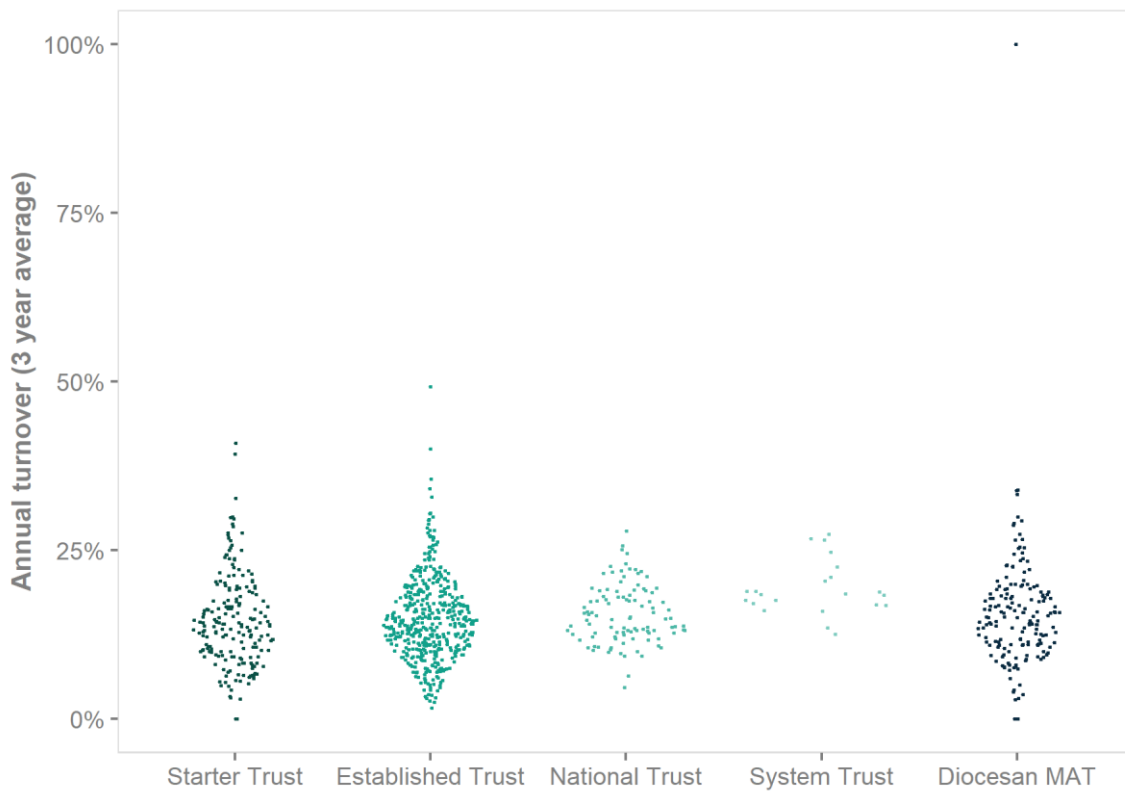


Figure 5.1.4: Swarm plot of annual turnover (three-year average) for MAT groups, 2019 only



Looking at Figure 5.1.3 we can see that there is an established trust and a diocesan MAT that both have an average annual teacher turnover of 100 per cent. Spot checks of groups with especially high turnover found that this was due to incomplete records in SWC, in which records for certain schools are missing for entire years. This makes it appear that a school has 100 per cent teacher turnover. We have not adjusted our resulting data to remove these cases. In future we will explore ways to identify high turnover that is due to this missing data.

Figures 5.1.5 and 5.1.6 repeat this for non-MAT groups. From these charts we can see that turnover in diocese and local authority groups is more narrowly distributed, with a wider, shorter 'swarm' of data points. On the other hand, there is a large amount of spread in the annual turnover values for federations and SATs. The 'bulge' for SATs is lower than for other groups, indicating the modal, or most common, value for this group type is relatively low and the mean value is brought up by a long tail of high-turnover schools. As expected from the overall distribution shown in Figure 5.1.2, almost all group types show some right-skew i.e. have a narrow tail of high turnover values.

Figure 5.1.5: Swarm plot of annual turnover (3-year average) for non-MAT groups, all years

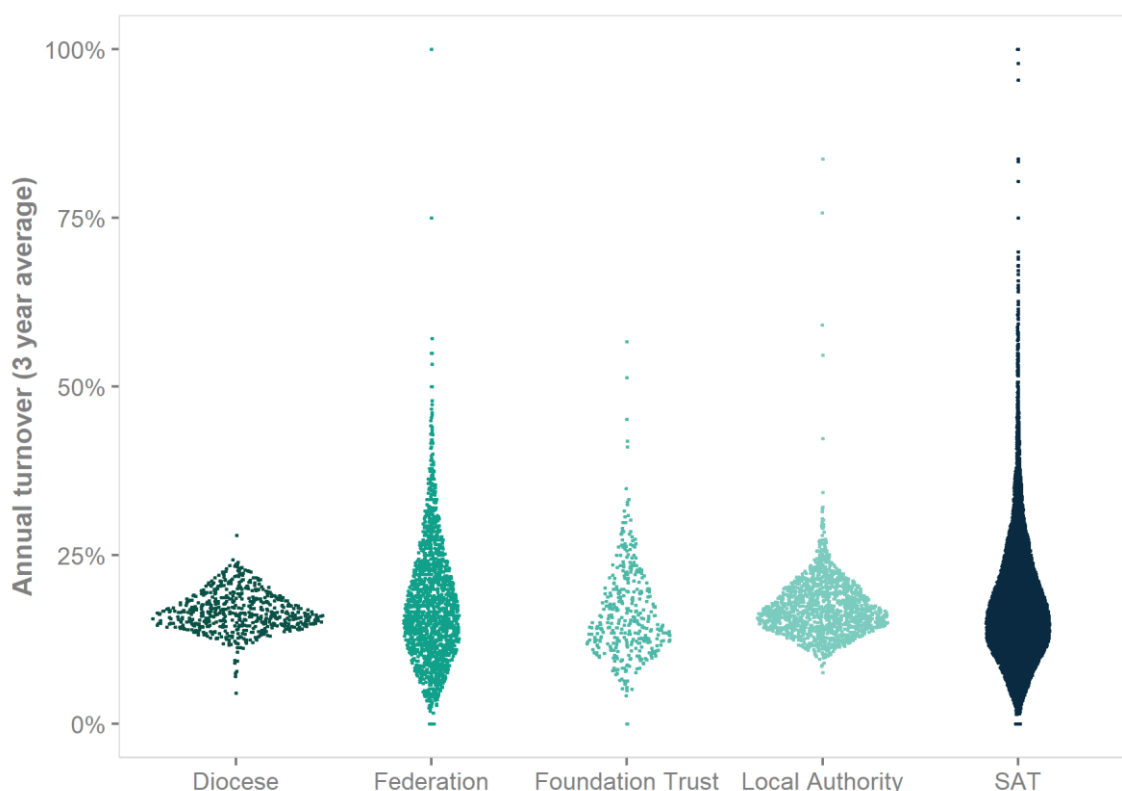


Figure 5.1.6: Swarm plot of annual turnover (3-year average) for non-MAT groups, 2019 only



5.2 Distribution of results – cumulative

For five-year cumulative turnover we have 5062 data points from 1750 unique school groups. Our inclusion criteria for cumulative turnover are:

- A school must have been part of the group for at least two years before the baseline year
- A school must be present in the group for all five following years
- A group (except an SAT) must have at least two schools meeting these criteria in order to be included

Group-level cumulative teacher turnover is calculated by looking at teacher exits across all schools in a group that meet the school level inclusion criteria i.e. cumulative turnover for a school group with 10 schools, of which three meet the school inclusion criteria, is based on the count of exits from the three eligible schools.

The breakdown of school group types and baseline years represented in the data is shown in Figure 5.2.1.

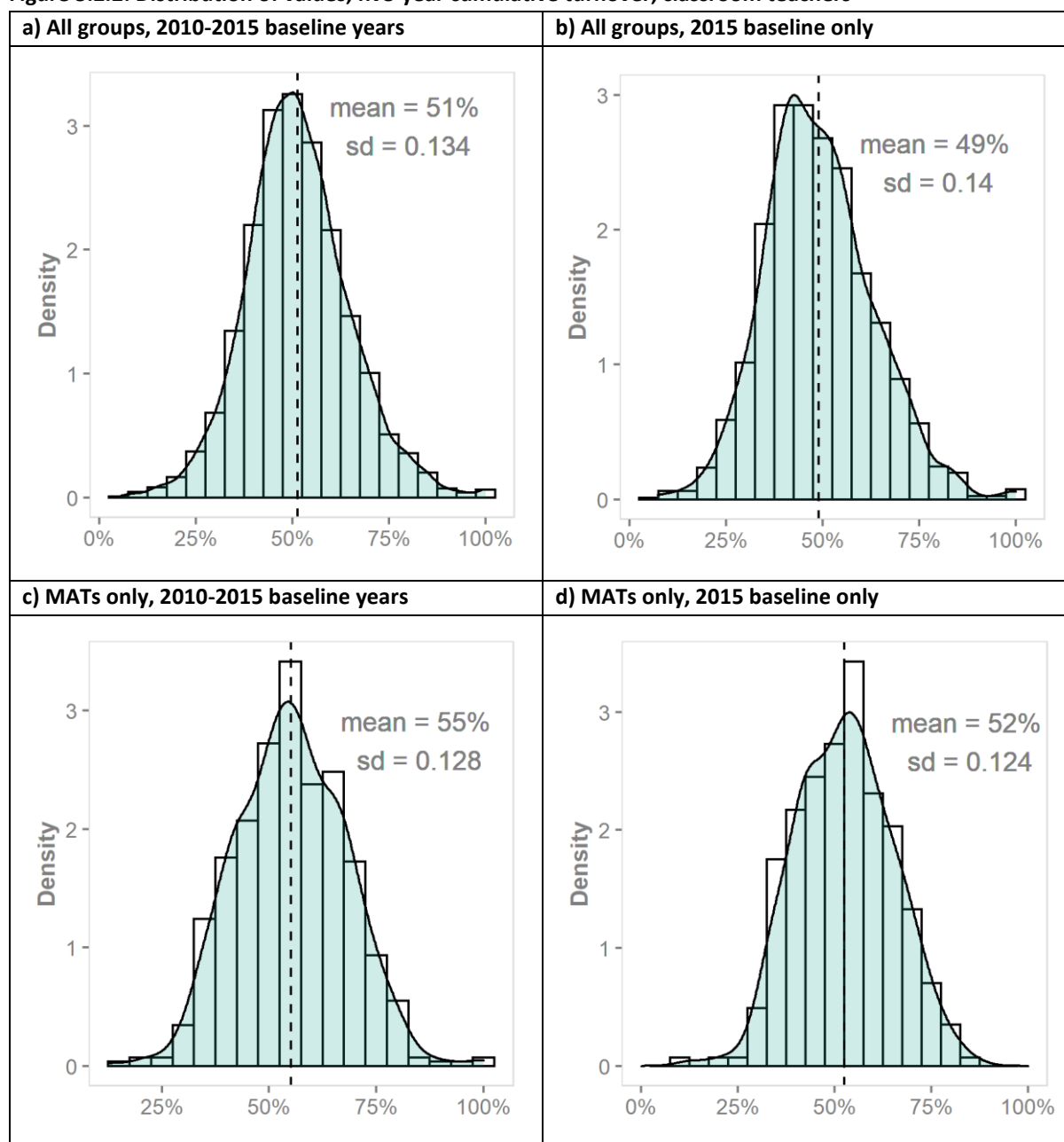
Figure 5.2.1: Data summary for five-year cumulative turnover

Group Type	2010	2011	2012	2013	2014	2015	Sum
Starter Trust	0	0	2	7	16	36	61
Established Trust	2	3	11	25	75	122	238
National Trust	2	4	8	17	40	59	130
System Trust	5	7	12	15	18	21	78
Diocesan MAT	0	0	1	5	19	48	73
Diocese	59	59	59	58	58	58	351
Federation	30	48	62	87	121	145	493
Foundation Trust	2	7	10	15	28	42	104
Local Authority	152	150	149	148	148	147	894
SAT	34	43	136	610	860	957	2640
Sum	286	321	450	987	1383	1635	5062

As for annual turnover, we plot the distribution of values for five-year cumulative turnover. Figure 5.2.2a shows that five-year cumulative turnover is approximately normally distributed when data from all school group types and all baseline years is included. Mean cumulative five-year turnover is 51 per cent, meaning around half of the teachers working in a school group in year n have exited by year $n+5$. The modal (most common) value is slightly lower than this. Slightly more school groups have a 100 per cent cumulative turnover than would be expected under a normal distribution. Mean turnover is slightly lower when only the most recent data (2015 baseline year) are included.

Looking only at MATs (Figures 5.2.2c and d) the data is less normal, with more results clustered around the mean and fewer outlying values. The mean five-year turnover value is higher for MATs than when all school groups are included (55 per cent in all years, 52 per cent for just 2015 baseline), even though moves within the same MAT group are not counted as exits in our data. The standard deviation is lower, again indicating that values for MAT groups are more tightly clustered together.

Figure 5.2.2: Distribution of values, five-year cumulative turnover, classroom teachers



Figures 5.2.3-5.2.4 show swarm plots of five-year cumulative turnover values, by group type. Looking at the MATs we can see there is more variability in cumulative turnover for the smaller school groups, as we might expect. One starter trust and one established trust have 100 per cent teacher turnover across five years, even when movements to other schools within the trust are not counted as an exit. Four starter trusts and one established trust lose fewer than 25 per cent of their teachers over a five-year period.

Figure 5.2.3: Swarm plot of five-year cumulative turnover for MAT groups, all baseline years

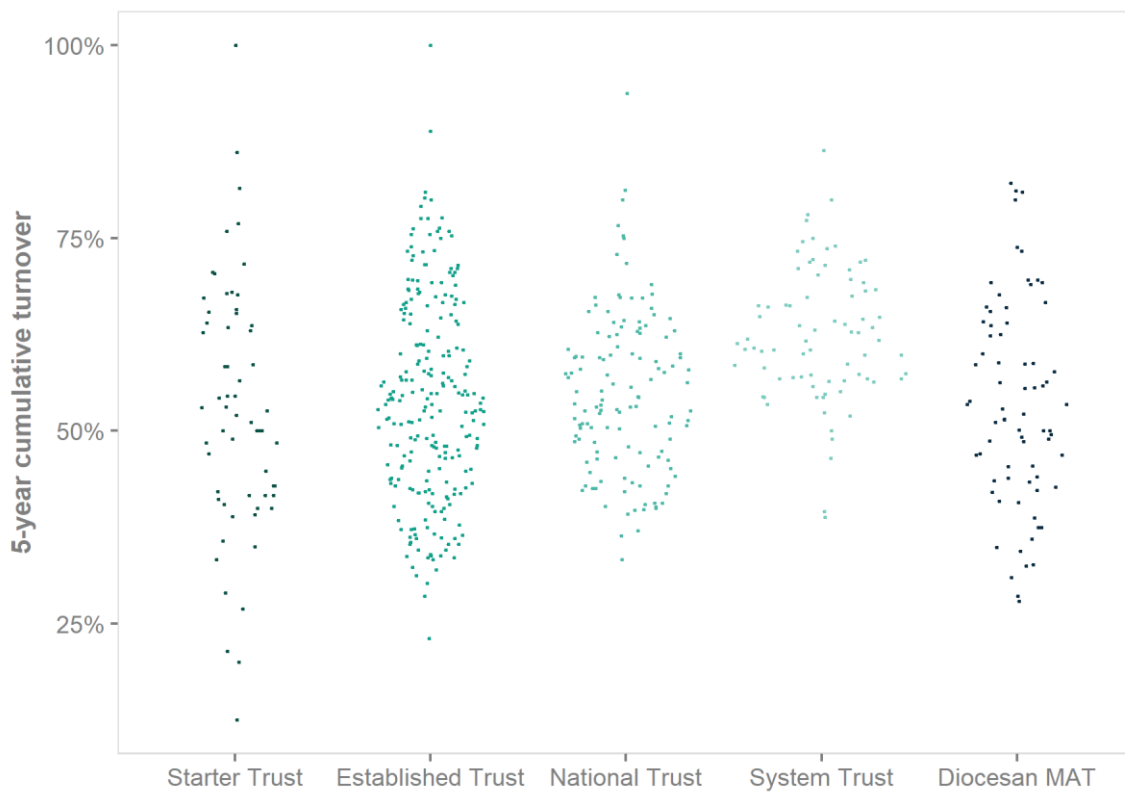
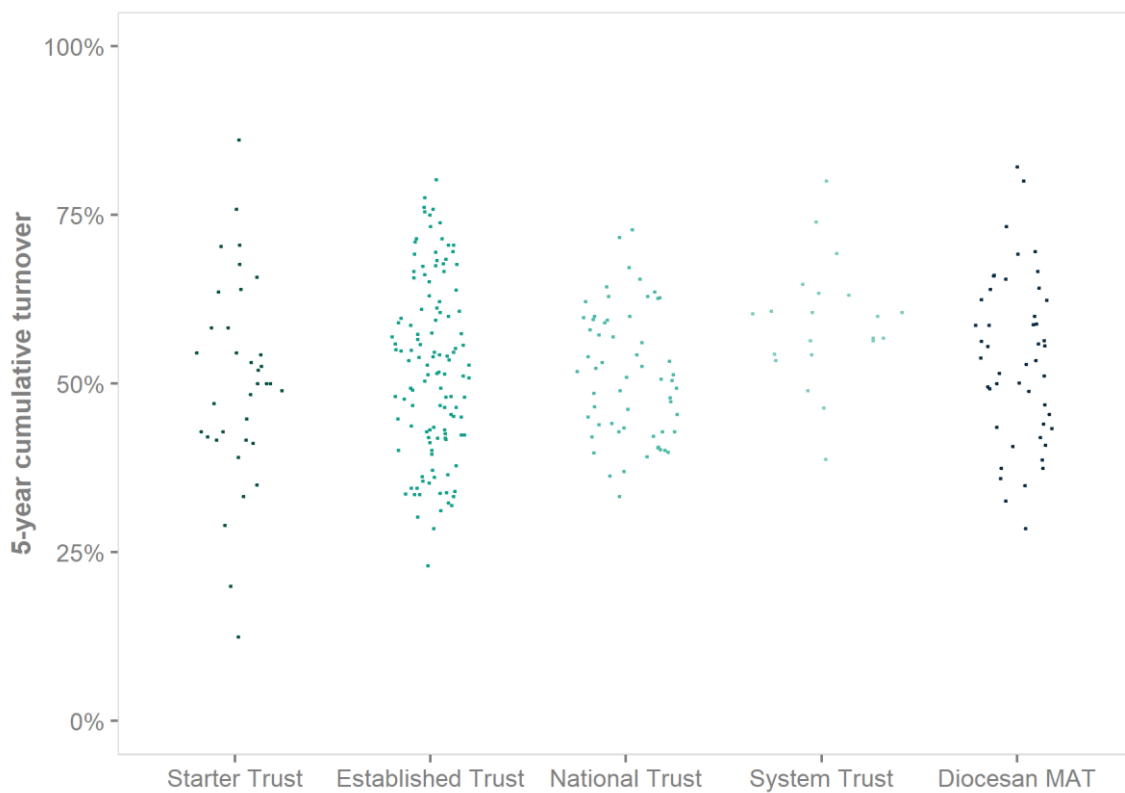


Figure 5.2.4: Swarm plot of five-year cumulative turnover for MAT groups, 2015 baseline only



Figures 5.2.5 and 5.2.6 show the same data for non-MAT groups. Turnover in diocese groups is clustered together, showing little variation. In contrast, there is wide variation in cumulative turnover rates for federations and SATs.

Figure 5.2.5: Swarm plot of five-year cumulative turnover for non-MAT groups, all baseline years



Figure 5.2.6: Swarm plot of five-year cumulative turnover for non-MAT groups, 2015 baseline only



5.3 Stability of the measures

In this section we investigate how stable our workforce metrics are, that is how much they change from year to year for individual school groups. We assume that the factors affecting turnover in school groups will be relatively stable, such that we do not typically expect large annual changes in turnover, particularly when schools new to groups do not contribute to our turnover figures until they have been part of a group for two years.

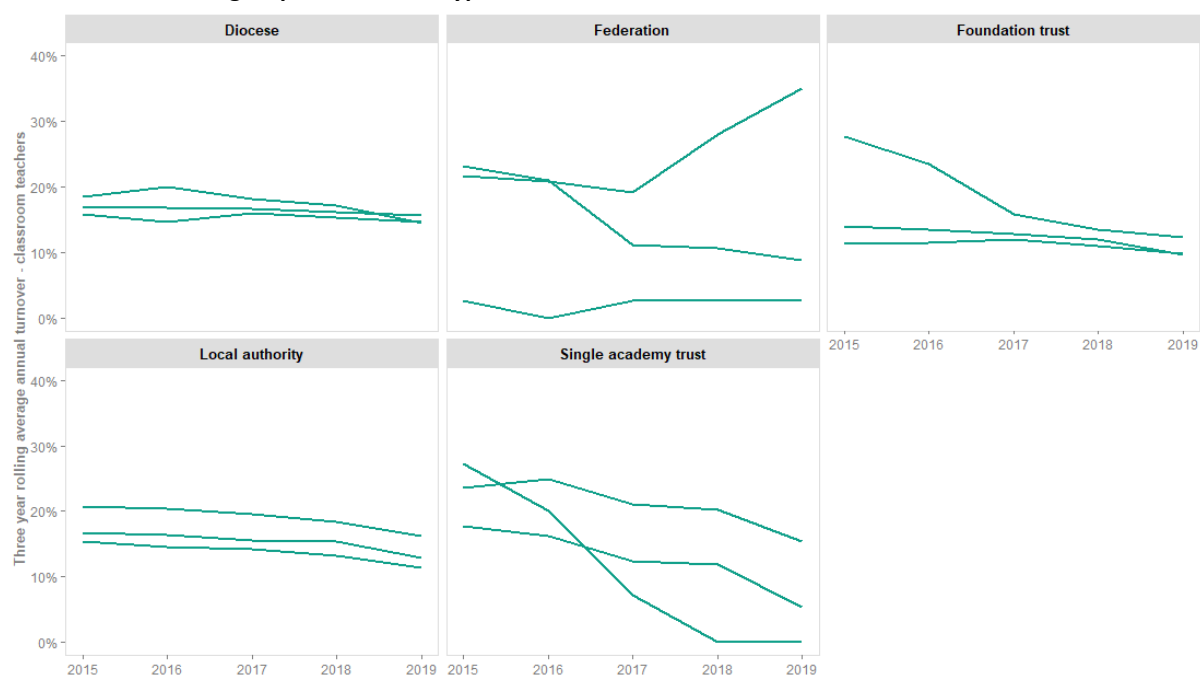
Our assumption that working conditions (and other relevant factors) are relatively stable from year to year has already influenced the measures we produce. For our annual turnover measure we take a rolling average of turnover in the three previous years. For cumulative turnover, measures of five-year turnover created for 2014 will share four years of data with the same measure created for a 2015 baseline. Given this, any large changes in either measure will likely conceal even greater year-to-year variation.

We investigate stability in two ways. First, we randomly selected three groups of each type, restricting our selection to groups with annual turnover data in every year between 2015 and 2019. The full data table can be found in the appendix (Figure A.A.1). We plot in Figures 5.3.1 and 5.3.2 how the metrics for these randomly selected groups change across the five years of interest.

Figure 5.3.1: Three year rolling average annual turnover of classroom teachers, in randomly selected individual MATs of different types



Figure 5.3.2: Three year rolling average annual turnover of classroom teachers, in randomly selected individual non-MAT groups of different types



We find that annual turnover within a school group can vary significantly from year to year, even after taking a three-year rolling average. Volatility can be observed in groups with small numbers of teachers, for example starter trusts and in single schools such as single academy trusts. However, significant variation from year to year is also observed in some but not all of the larger groups, such as one of the selected system trusts. Local authorities, which are the largest of these randomly selected groups, have the most stable annual turnover.

Figures 5.3.3 and 5.3.4 repeat the same procedure but for five-year cumulative turnover figures. As not all the groups selected above have data for five-year cumulative turnover, we draw a new random sample from those groups for which we have five-year cumulative turnover figures for a least baseline years 2013-2015.

Within our random samples, our cumulative turnover metric is more stable than our annual turnover metric. This might be expected, given that the way this metric is calculated means that 80 per cent of the data used to calculate it is shared from one year to the next.

Our second assessment of the stability of the measures looks at the whole sample of school groups for which we have turnover metrics. We present cross tabulations showing change in quartile from year to year. For all groups in each year we rank and allocate quartiles from lowest to highest turnover. We then compare which quartile a school group is located in one year with the previous one. We present results for the most recent two years in our datasets. We cross-checked this analysis with the next most recent two years and found similar results. As an additional cross-check, we also repeated the annual analysis with deciles and found similar results.

If our metrics are stable, then we would expect most groups to remain in the same quartile from year to year.

Figure 5.3.3: Five-year cumulative turnover across different baseline years, in randomly selected individual MATs of different types

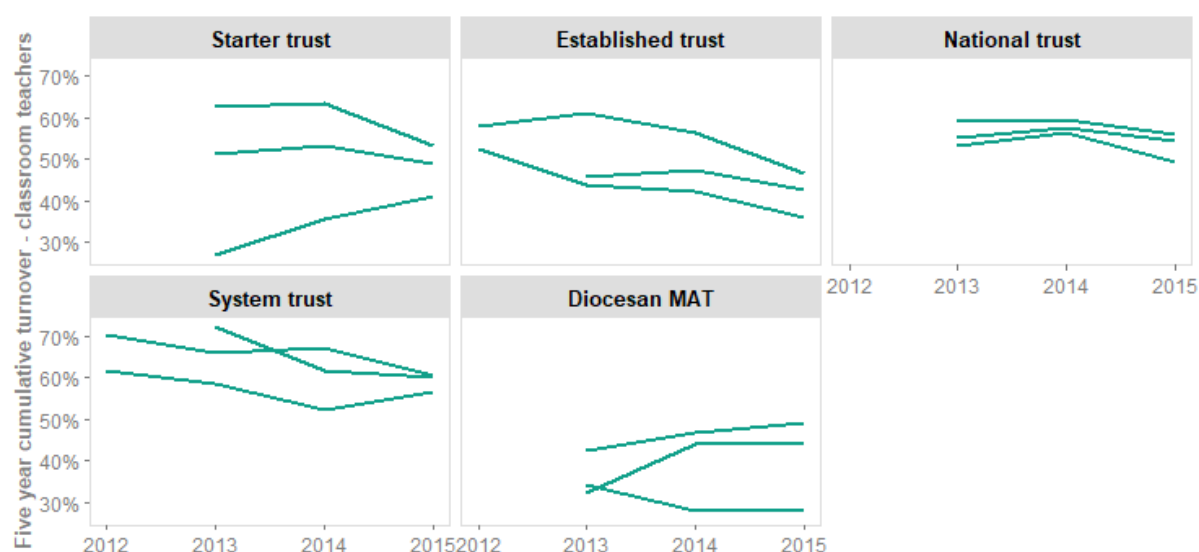
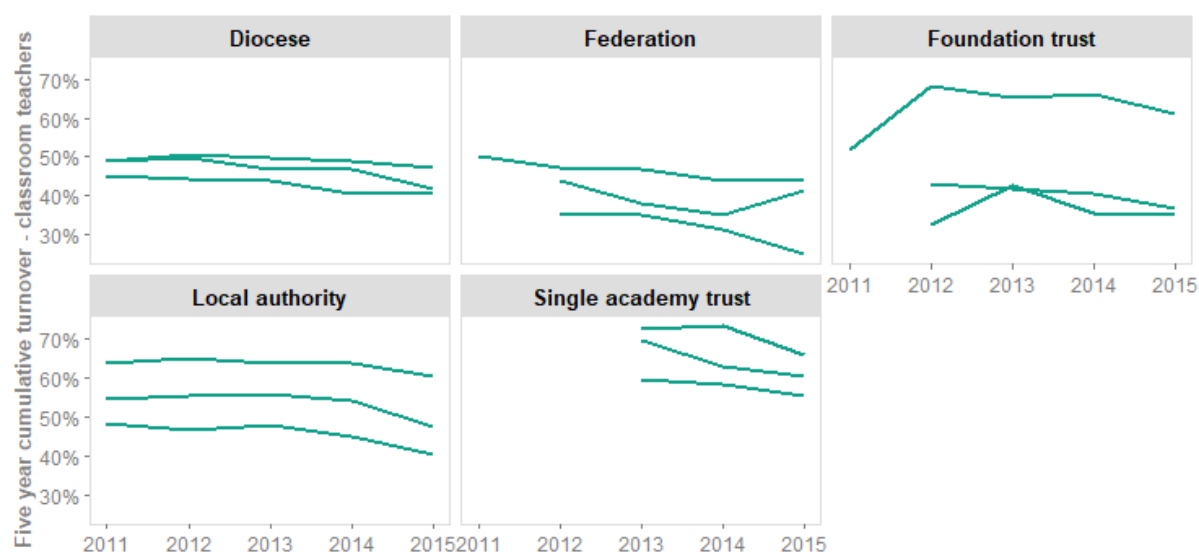


Figure 5.3.4: Five-year cumulative turnover across different baseline years, in randomly selected individual non-MAT groups of different types



We find both measures to be fairly stable, with most school groups remaining in the same quartile from year to year. For annual turnover, 882 school groups out of 1,322 (67 per cent) remained in the same quartile between 2018 and 2019. For five-year cumulative turnover, 363 school groups out of 514 (71 per cent) remained in the same quartile between baseline years 2014 and 2015.

Where groups do move into a different quartile this is most often to the next nearest quartile. Only in one per cent of cases we see a large step change from the lowest to the highest quartile.

For both types of turnover, we find the middle of the distribution is less stable. This is because there is a smaller difference between the middle quartiles than there is between the middle quartiles and either end of the scale.

Figure 5.3.5: Year-to-year change in quartile, annual turnover (three-year rolling average), 2018 to 2019

		2019 quarter				Total
		1 (Low turnover)	2	3	4 (High turnover)	
2018 quarter	1	68%	26%	5%	1%	100%
	2	11%	60%	26%	3%	100%
	3	3%	17%	60%	20%	100%
	4	1%	2%	17%	79%	100%

Figure 5.3.6: Year-to-year change in quartile, cumulative turnover (over five years), baseline years 2014 and 2015

		2015 quarter				Total
		1 (Low turnover)	2	3	4 (High turnover)	
2014 quarter	1	78%	15%	5%	1%	100%
	2	20%	66%	13%	2%	100%
	3	4%	24%	60%	13%	100%
	4	0%	3%	18%	79%	100%

Our measure of cumulative turnover over five years is slightly more stable than our three-year average annual turnover measure. Seventy-eight per cent of school groups in the top quartile for five-year cumulative turnover with baseline year 2014 are also in the top quartile for the same measure starting in 2015. This compares with 68 per cent of school groups remaining the top quartile in both 2018 and 2019 for the three-year rolling annual turnover measure.

In contrast to annual turnover, school groups' cumulative turnover is also more likely to improve by a quartile than to decline by a quartile. Twenty per cent of school groups in the 2nd quartile for cumulative turnover between 2014 and 2019 moved into the 1st quartile for their cumulative turnover between 2015 and 2020. Twenty-four per cent of school groups made a similar movement between the 3rd and 2nd quartile. By contrast, school groups that move quartiles in annual turnover are more likely to decline to a quartile with higher turnover.

There is no rule of thumb for a sufficient or desirable level of stability. Where appropriate we have taken averages over several years to soften the effects of any short-term fluctuations and as a result we are satisfied these measures are suitably stable. The majority of school groups can expect to have broadly similar results from one year to the next.

5.4 Choosing a measure

We have presented two complementary measures of teachers' turnover: annual turnover (averaged over three years) and five-year cumulative turnover. The analysis above has shown that

- More data is available for annual turnover (17,020 data points compared to 5,062)
- Cumulative turnover is more normally distributed
- For each group type, there is more variation in cumulative turnover than annual turnover
- Cumulative turnover measures are more stable

Given this, we select cumulative turnover as our preferred measure for further analysis. The drawback of this decision is both that we have less data available and that the data we have is less contemporary, as cumulative turnover figures reflect conditions in school groups across 2015-2019. However, we believe that the cumulative turnover measure is both more useful at this stage and likely to improve over time. In the following section we attempt to identify school groups with high-turnover and as normally-distributed data meets the assumptions of a wider variety of statistical tests we have more options for how to do this using cumulative turnover data. Furthermore, our inclusion criteria for the cumulative turnover metrics are quite rigorous:

- A school must have been part of the group for at least two years before the baseline year
- A school must be present in the group for all 5 following years
- A group (except an SAT) must have at least two schools meeting these criteria in order to be included

The 2010-2019 time period encompasses the roll out and expansion of the academies program, where there has been a large amount of movement of schools between groups. We expect that, over the coming years, school group membership will be more stable and therefore more schools and school groups can be included within our cumulative turnover metric.

A concern is that our rigorous inclusion criteria for the cumulative turnover data is that we preferentially include turnover figures from schools that have a stable group membership. The fact that schools have changed group might affect their turnover. For example, teachers may choose to work in a particular (type of) school group and leave when a school changes group membership. Alternatively, the characteristics of schools with unstable group membership may differ from those with stable group membership (for example, they may have weak leadership). This would be more problematic if we were looking at school-level turnover. Because we look at turnover at a group level, we require the school to be a member of a group for at least two years before we include it in our data.

5.5 Identifying outliers

In Figure 5.5.1 we plot our cumulative turnover measures on a funnel plot. Funnel plots are a way of comparing institutional performance without seeking to produce a rank order.⁴⁶ Funnel plots originated within manufacturing to try and separate 'expected' variation inherent in the process from 'unusual' variation that warrants additional attention.⁴⁷ We expect any measures of institutional performance, such as staff turnover, to show some variation. However, funnel plots attempt to isolate variation arising from 'common causes', which affect all part of the system from variation arising from 'special causes', which do not affect all parts of the system.⁴⁸ We seek to identify the school groups where turnover is affected by special causes, indicating good or poor practice at the group level that leads to low or high staff turnover.

In the funnel plots below cumulative turnover values for each school group are plotted against the number of teacher records of employment over the five-year period. This is the number of 'slots' available to be filled in the five-year period rather than the number of distinct teachers employed (the same teacher employed for each of five years would count as five records). The horizontal line

⁴⁶ Spiegelhalter, 'Funnel Plots for Comparing Institutional Performance'.

⁴⁷ Mohammed et al., 'Bristol, Shipman, and Clinical Governance'.

⁴⁸ Fugard et al., 'Analysing and Reporting UK CAMHS Outcomes'.

through the middle of the funnel marks overall five-year cumulative turnover, calculated from the overall number of teacher records and overall number of teacher exits across all schools included in our cumulative turnover metrics. The funnel lines are then drawn by calculating the standard error of the mean and multiplying this by 1.96 and 3 for each available value of n (the number of teacher records) to create the 95 per cent and 99.7 per cent confidence intervals for our population proportion estimate. Further details are provided in Appendix B.

The standard error of the mean gets smaller as the sample size increases so when plotted on a graph with counts of teacher records on the x-axis the confidence intervals are wider when x is smaller and narrower when x is bigger, giving the characteristic funnel shape. The plotted confidence interval lines are referred to as control limits. A data point which falls outside the control limits is thought to be subject to special cause variation and therefore worthy of investigation. Within healthcare organisations these have been identified as the thresholds for signalling alarm (95 per cent CI) and action (99.7 per cent CI).⁴⁹

Figure 5.5.1 shows a funnel plot of cumulative turnover for all school groups for the 2015 baseline year only. For simplicity, school groups which fall within the calculated confidence intervals are shaded as grey. Groups which fall outside the confidence intervals are shaded according to their group type. Groups which have fewer than 100 teacher employment records are not displayed as control limits are not recommended as a reliable way of identifying unusual variation when sample size is small. Data from these groups is incorporated in our calculations of the overall cumulative turnover rate. SATS are included in calculations of the upper and lower confidence intervals and mean, but not displayed. Figure 5.5.2 lists how many groups of different types fall outside of the 95 and 99.7 per cent control limits.

Looking at Figures 5.5.1 and 5.5.2 we can see that 57 per cent of values lie outside the 95% limits and 40 per cent lie outside the 99.7% SD limits. In other words, just under 60 per cent of groups are identified as statistically significantly different from average. High deviations from the average value are not uncommon in performance metrics designed to show difference between units, indeed the proportion is of a similar order to the proportion of schools that are identified as statistically significant under the government's key measure of secondary school performance, Progress 8. However, there may be factors that cause systematic differences between school groups that are not related to the decisions taken by groups themselves.

⁴⁹ Seaton and Manktelow, 'The Probability of Being Identified as an Outlier with Commonly Used Funnel Plot Control Limits for the Standardised Mortality Ratio'.

Figure 5.5.1: Funnel plot of five-year cumulative turnover figures (2015 baseline, groups with more than 100 teacher employment records only)

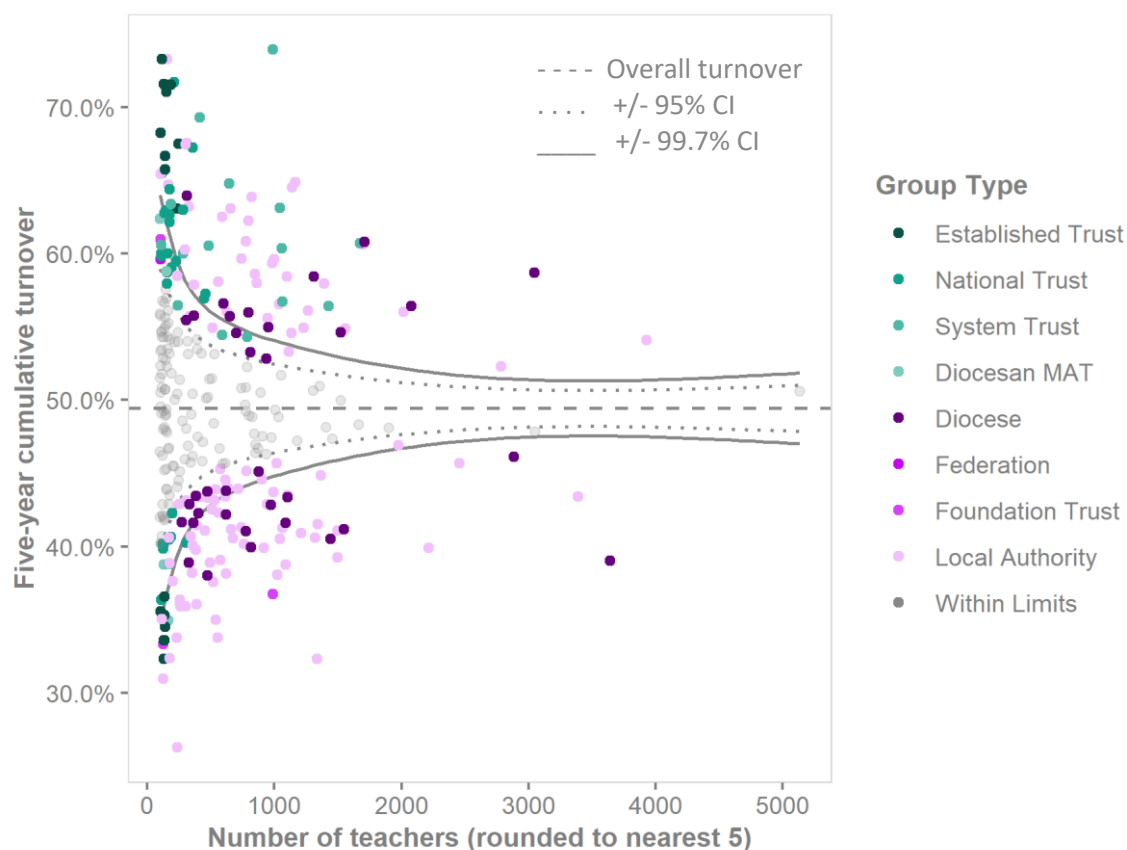


Figure 5.5.2: Number of groups of each type lying outside of the control limits for five-year cumulative turnover (2015 baseline, groups with more than 100 teacher records only)

Group Type	Total in data	Above control limit				Below control limit			
		95%		99.7%*		95%		99.7%*	
		n	%	n	%	n	%	n	%
Established Trust	48	10	21%	9	19%	7	15%	5	10%
National Trust	46	17	37%	12	26%	7	15%	1	2%
System Trust	19	15	79%	11	58%	1	5%	0	0%
Diocese MAT	15	2	13%	0	0%	2	13%	1	7%
Diocese	55	15	27%	10	18%	20	36%	12	22%
Federation	2	2	100%	1	50%	0	0%	0	0%
Foundation	5	1	20%	0	0%	3	60%	2	40%
LA	142	39	27%	35	25%	66	46%	47	33%
SAT	72	9	13%	6	8%	16	22%	8	11%
Total	404	110	27%	84	21%	122	30%	76	19%

*Data points that are outside of the 99.7% control limit are a subset of those outside the 95% control limit.

For example, we can draw a funnel plot using data only from MAT group types. Figure 5.5.3 redraws our funnel plot using a mean and limits calculated using data only from MAT group types. As for the previous figure, MATs with less than 100 records are not plotted. For the MAT groups included in the funnel plot 50 per cent lie outside of the 95 per cent limits and 26 per cent lie outside of the 99.7 per cent limits. The proportion of school groups outside of the limits is less than when we consider MATs alongside all other group types, however a large number of trusts are significantly different from average.

Figure 5.5.3 Funnel plot of cumulative turnover for MATs (2015 baseline, groups with more than 100 teacher employment records only)

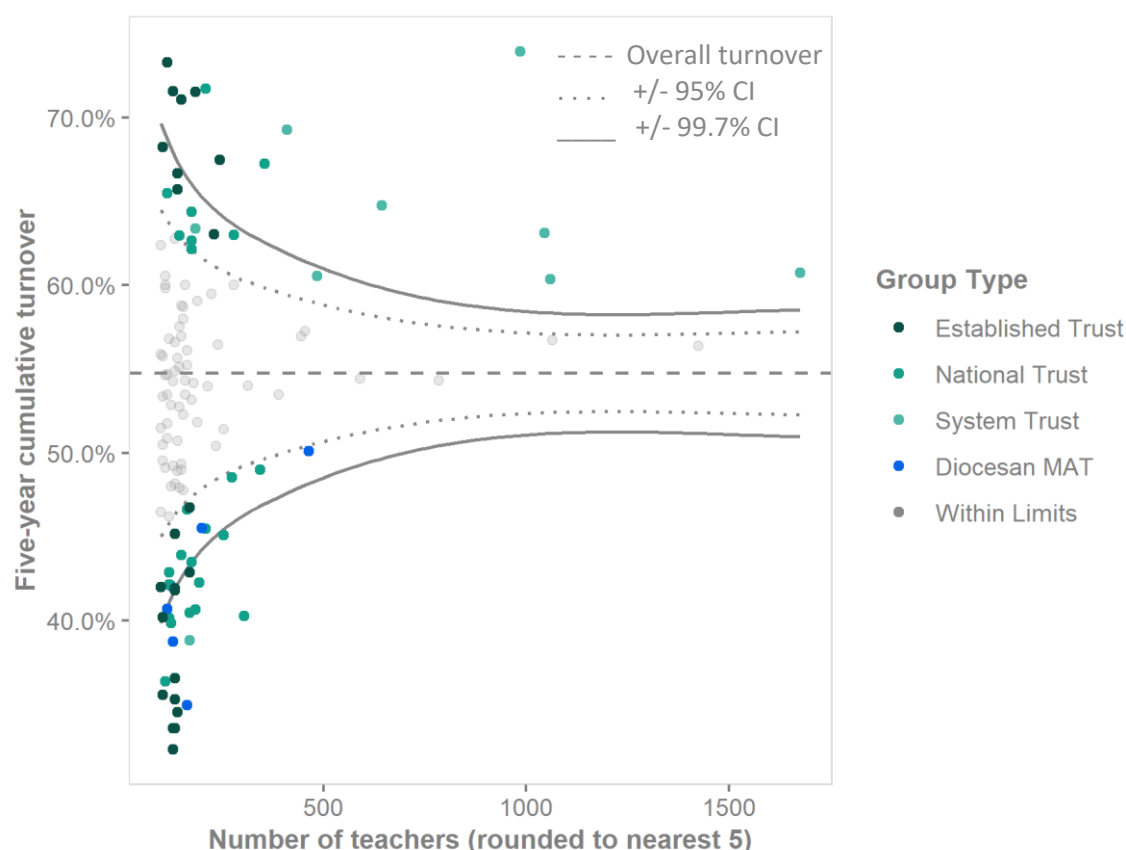


Figure 5.5.4: Number of groups of each type lying outside control limits for five-year cumulative turnover (2015 baseline, MATS only, groups with more than 100 teacher records only)

Group Type	Total in data	Above control limit				Below control limit			
		95%		99.7%		95%		99.7%	
		n	%	n	%	n	%	n	%
Established Trust	48	9	19%	5	10%	15	31%	9	19%
National Trust	46	8	17%	2	4%	16	35%	8	17%
System Trust	19	8	42%	6	32%	1	5%	1	5%
Diocese MAT	15	0	0%	0	0%	6	40%	3	20%
Total	128	25	20%	13	10%	38	30%	21	16%

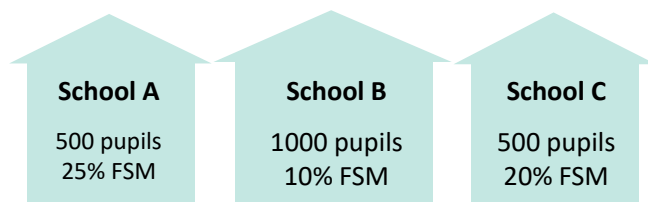
5.6 Adding context

To look at how we might be able to incorporate some of the other factors known to affect teacher turnover we add some contextual information about the schools that make up different school groups. We use school-level information from Get Information About Schools (GIAS), from which we select a complete download of All Establishment Data as of 5/11/2020 (the date of the 2020 School Workforce Census). We add to our existing data the following information: the number of pupils in each school, the proportion of pupils eligible for free school meals, current Ofsted grade and when this last changed, and the lower super-output area in which the school is located. In this initial analysis we look only at the number of pupils and the proportion eligible for free school meals.

Using school-level pupil counts and free school meal share we calculate the proportion of pupils eligible for free school meals at a group level. However, this metric treats as equal a trust that has an average FSM share in all their schools and a trust where some schools have a very high and others a low proportion of FSM-eligible pupils. Given this, we also test a measure of the share of pupils at each trust educated in a school where the proportion of pupils eligible for FSM is in the top quintile. We calculate this by ranking all schools based on the percentage of FSM-eligible pupils and divide this ranked list into 5 groups, with a broadly equal number of schools in each group (schools with equal rank are always allocated to the same group so there is some slight difference in group size). Schools ranked in the highest quintile are marked as high-FSM schools. We then calculate the proportion of pupils in a trust that are educated in high-FSM schools. The difference between the two measures (Trust FSM share and Trust High FSM share) is shown in Figure 5.6.1.

Figure 5.6.1: Graphical illustration of the differences between the two group-level free school meals measures.

Group A



$$\begin{aligned}\text{Group \% FSM} &= (500 \times 0.25) + \\ &\quad (1000 \times 0.1) + \\ &\quad (500 \times 0.20) / \\ &\quad (500 + 1000 + 500) = 16.5\%\end{aligned}$$

Schools in top 20% FSM share = School A
Group 'high FSM' share = $500 / 2000 = 0.25$

Group B



$$\begin{aligned}\text{Group \% FSM} &= (1000 \times 0.19) + \\ &\quad (1000 \times 0.20) / \\ &\quad (1000 + 1000) = 19.5\%\end{aligned}$$

Schools in top 20% FSM share = None
Group 'high FSM' share = $0 / 2000 = 0.00$

We were able to match pupil demographic information to 21,623 of the 24,947 schools in our group membership database for 2020. Full details of the matching process are available in Appendix C. These schools are then matched back to their groups.

We have annual turnover data for teachers in 2019 for 2,904 school groups. Since our FSM measures do not vary from year to year, we use only a single year of turnover data and chose 2019 as the year closest to that for which we have FSM measures available. There are 56 school groups we are unable to match with contextual data from Get Information About Schools. This comprises 1 local authority, 9 Diocese MATs and 47 SATs. Further investigation revealed that the local authority had no schools that were solely LA-managed (i.e. not also part of a diocese, federation or foundation) in 2020 (but had done until that academic year).

For cumulative turnover we use data with the 2015 baseline year. We start with records for 1,635 school groups for which one (a sixth-form SAT) cannot be matched with data on FSM eligibility. Figure 5.6.2 shows the number of each group type present in the data sets.

Figure 5.6.2: Summary of turnover data matched to group-level FSM metrics

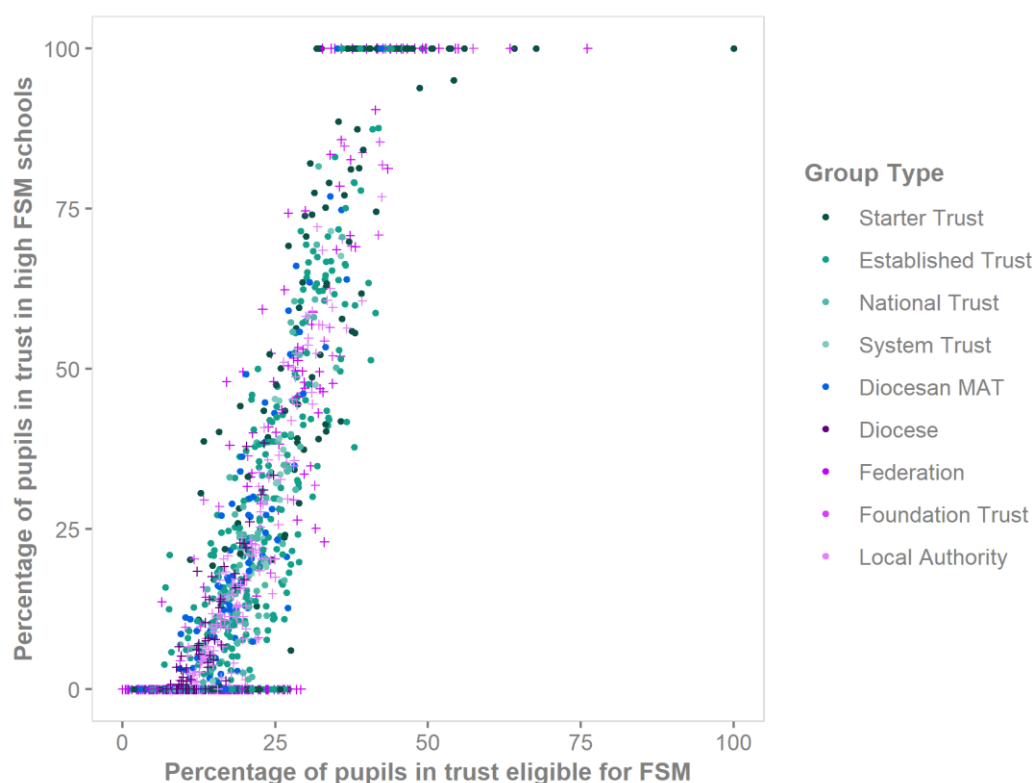
Dataset	Number of records		
	Before matching	Matched	Unmatched
Annual turnover (all years)	17,020	15,224	1,796
Annual turnover (2019 only)	2,904	2,847	57
Cumulative turnover (all years)	5,062	4,929	133
Cumulative turnover (2015 baseline)	1,635	1,634	1

Group type	Turnover metrics (latest year only)	
	Annual turnover	Cumulative turnover
Starter Trust	198	36
Established Trust	468	122
National Trust	103	59
System Trust	22	21
Diocese MAT	162	48
LA	147	147
Diocese	58	58
Federation	330	145
Foundation	65	42
SAT	1294	956
Total	2904	1634

We start by comparing our two measures of pupil disadvantage: the share of pupils in the group who are eligible for FSM and the share of pupils in the group educated in schools that have a high proportion of pupils eligible for FSM. Figure 5.6.3 plots the two measures against each other for school groups where we have matched annual turnover data. SATs are removed as they represent a single school, hence the percentage of pupils educated in schools with a high proportion of FSM pupils becomes a binary measure. In Figure 5.6.3 MAT groups are shown in green with a circular data marker and non-mat groups shown in pink with a cross.

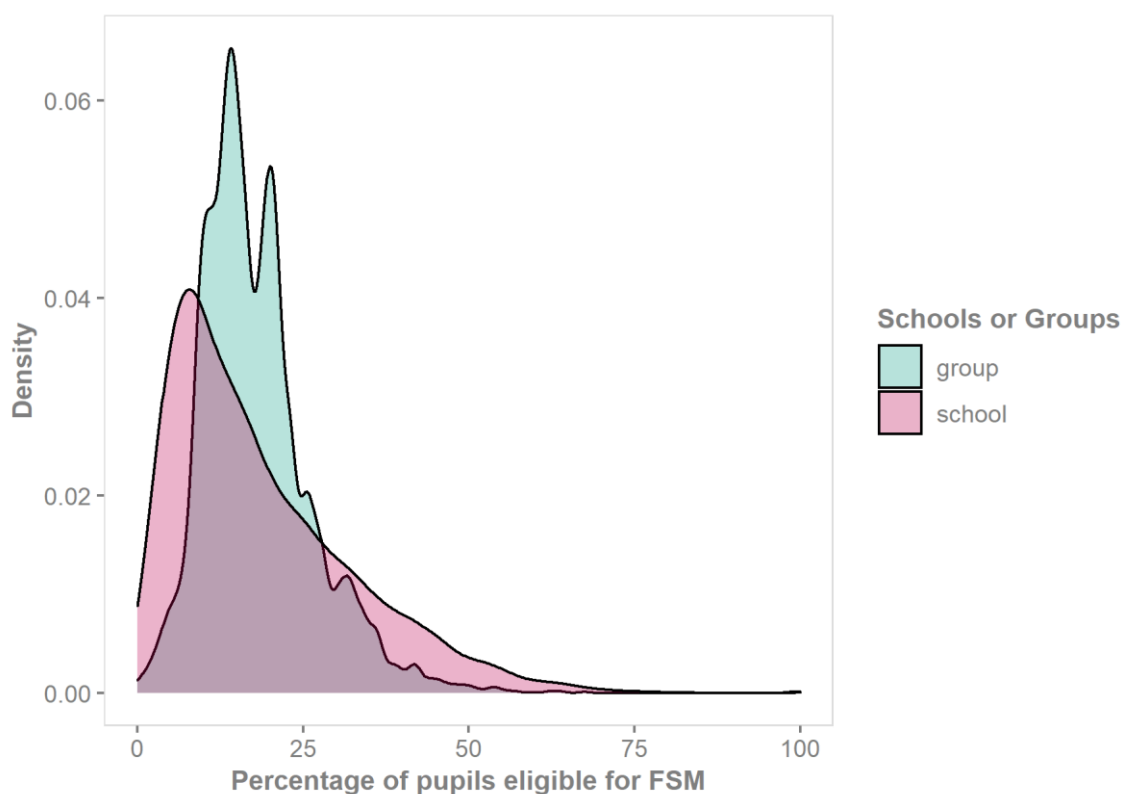
The two measures are strongly correlated, with a Pearson correlation coefficient of 0.87. Being strongly correlated means that there is a large amount of co-variance: as the proportion of FSM eligible pupils increases, the proportion of pupils educated in high-FSM schools also increases. However, the correlation is not perfect: some groups have a modest overall FSM share but a relatively large proportion of pupils in schools with high FSM share (suggesting they have some schools with very deprived intakes and others that educate relatively few disadvantaged pupils) and for others the reverse is true. The trust with 100 per cent of pupils eligible for FSM is a small trust focussing on alternative provision.

Figure 5.6.3: Percentage of FSM eligible pupils in each group against the percentage of pupils in that group educated in school with a high proportion of pupils eligible for FSM



Given that the two measures are highly correlated it is not clear which one should be preferred. As expected, the proportion of pupils educated in high FSM schools measure has a larger number of 0 and 100 values. Given this we focus on the simple proportion of pupils in a trust eligible for FSM in our remaining analysis as this maximises the amount of variation between trusts. For illustrative purposes, Figure 5.6.4 shows how the distribution of this measure compares to the distribution of individual school FSM shares. At a school level, the distribution is unimodal with a right-hand skew. For groups, the distribution is less smooth (as would be expected as there are few individual data points) and bimodal, with peaks at around 15 and 21 per cent FSM share. The distribution is still right skewed but less so than for individual schools. Again, this is to be expected as aggregating data to group level will reduce the presence of extreme values.

Figure 5.6.4 Distribution of school-level FSM share compared to distribution of trust-level FSM share



Figures 5.6.5 and 5.6.6 show how the proportion of pupils in a school group eligible for FSM varies for different group types. As described above, we calculate our trust FSM share measure from 2020 pupil characteristic data downloaded from Get Information About Schools. System trusts and diocese groups have a short, wide distribution suggesting the trust FSM share values for these group types are tightly clustered, with few outliers. In contrast the distribution of values for starter trusts is long and thin, showing that trust FSM shares for this group are spread out across the whole range of values. One starter trust and one SAT have 100 per cent FSM eligibility. These both represent very small school groups focused on providing Alternative Provision.

Figure 5.6.5: Swarm plot of percentage pupils in group eligible for FSM for MAT groups



Figure 5.6.6: Swarm plot of percentage pupils in group eligible for FSM for non-MAT groups



Figure 5.6.7 looks at the relationship between the trust-level proportion of pupils eligible for free school meals and our five-year cumulative turnover measure. It is a scatter plot showing turnover figures plotted against trust-level FSM share. SATs are included in our calculation of the correlation

coefficient but, for simplicity, are not plotted on the graph. The Pearson correlation coefficient is 0.181 (± 0.047) and $p < 0.05$. Correlation between the two factors is therefore negligible.

Despite this, we investigate what happens if we present our turnover metrics separated into categories by trust FSM share. We start by taking all groups in our data for which we have a trust-level FSM share and dividing them into four equally-sized groups based on FSM share: low, medium-low, medium-high and high. This allows us to see where the groups for which we do have cumulative turnover data sit in the ranking of pupil FSM share, without incorporating any bias with respect to whether groups with higher or lower shares of FSM pupils are more likely to be present in our cumulative turnover figures. We apply this classification to the groups for which we have both a trust FSM share and five-year cumulative turnover metrics and recalculate the means and control limits for each group. The results are presented in Figure 5.6.8a-d.

The numbers of groups, by group type, falling outside of the control limits for Figures 5.6.8a-d are given in Appendix D. The number of groups falling outside the control limits is still high (55 per cent of groups outside of the 99.7 limit for groups with a high FSM share), suggesting that there are still unmeasured factors associated with turnover in these groups.

Figure 5.6.7: Scatterplot showing the relationship between group-level percentage of pupils eligible for FSM and five-year cumulative turnover

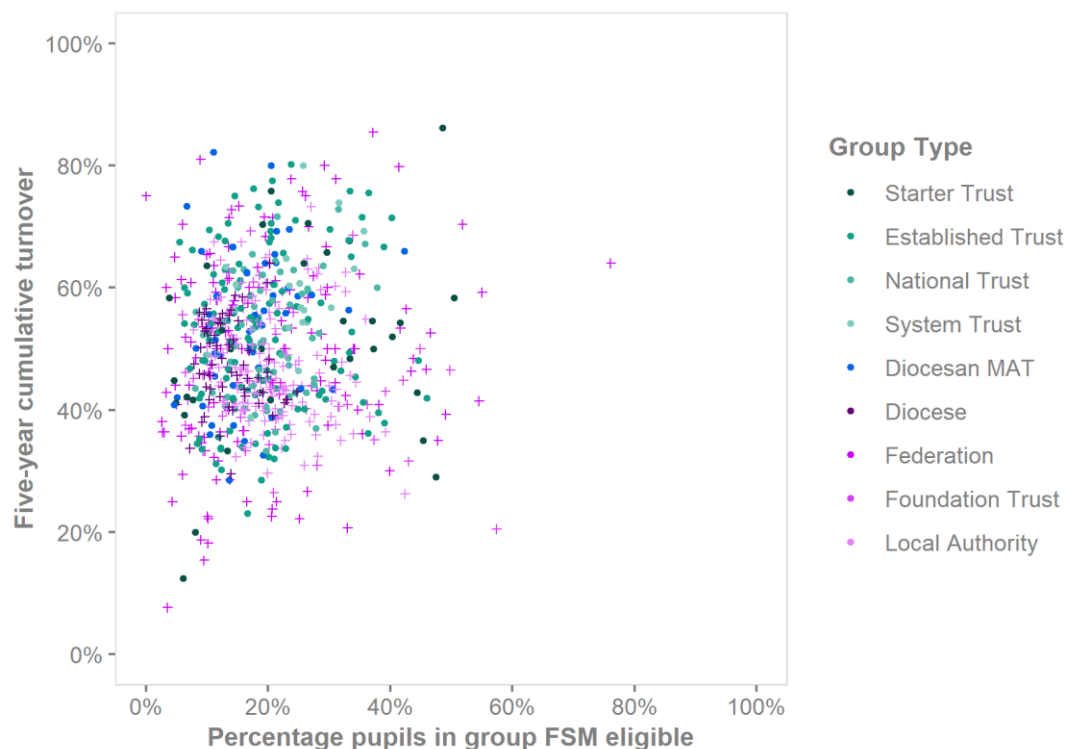
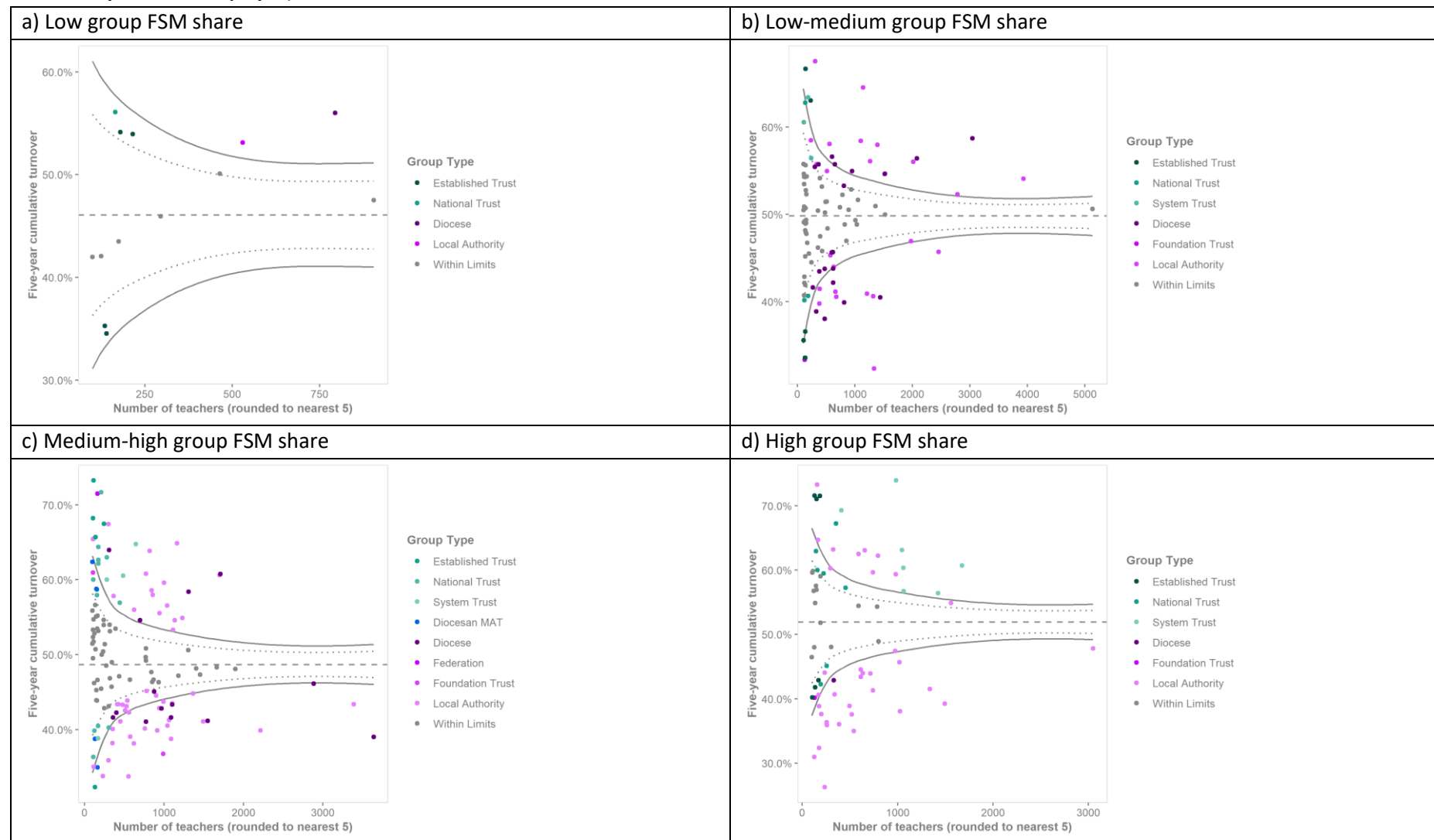


Figure 5.6.8: Funnel plots of five-year cumulative turnover, by group FSM share (all group types, 2015 baseline only, groups with more than 100 teacher employment records only, SATs not displayed)



6. Conclusions and consultation questions

We have developed new measures of teacher turnover to try and identify school groups with particularly strong workforce management. For the first time, we calculate teacher turnover at a group level. We produce two different teacher turnover measures and find our cumulative turnover measure, which looks at teacher exits over a five-year period, is more stable and more amenable to further analysis. From this we are able to identify some differences in turnover by group type. For the school groups for which we have data, 79 per cent of system trusts have cumulative turnover that is statistically above average, whereas for 46 per cent of local authorities their turnover is significantly lower than average. However, this large number of groups with turnover above or below the average means that we may not be adequately controlling for differences between school groups and we welcome feedback on how we can fairly control for the different circumstances in which trusts are operating.

In the work presented above, we link school-level employment data to records of school group membership. This presents challenges in terms of how to deal with schools that change group membership. If a school academises or is re-brokered then it is officially recognised as a new institution by the DfE and given a new unique reference number. However, this does not represent a decision by staff to leave the old school and therefore we do not count this as turnover. Furthermore, to allow the effects of belonging to a new group to take effect, we only include schools that have been part of a group for at least two years. The last 12 years have been volatile ones for school group membership. A large proportion of schools have changed group membership in some way since the expansion of the academies programme in 2010, which has led to 47 per cent of all schools becoming academies. We must caution that this means non-trivial amounts of data are not included in our turnover estimates, but we are open to feedback on how we might better reflect the dynamics of the system during this period. In future, we expect group membership to become more stable and the effects of this to reduce. This may lower our estimates of teacher turnover as we might expect turnover to be highest in schools which are undergoing organisational changes.

After schools have been located within groups, we calculate staff exits at a group level. When doing this we apply different rules to different group types, based on our expectations of the strength of links between different types of school group. We find that multi-academy trusts typically have higher levels of turnover than diocese and local authority schools on our preferred measure of teacher turnover.

That preferred measure is five-year cumulative turnover. We calculate both average annual turnover (the average proportion of teachers in a group who leave each year) and five-year cumulative turnover (the proportion of staff who exit a group during a five-year period). Cumulative turnover may give a more holistic picture of instability in schools, and we find the distribution of this measure more amenable to further analysis. However, the data requirements for calculating longer-term turnover measures means that only schools that have stable group membership can be included. The problem outlined above, of excluding 'unstable' schools, may therefore be more severe when this measure is chosen.

We use our raw turnover measures to identify school groups which have particularly high or low teacher turnover. However, using a well-established approach to identify outlying organisational

performance, the degree of variation may limit our ability reliably identify groups that pose either cause for concern or could be identified as sites of good practice on raw scores alone.

Next steps

In order to identify outlying school groups, we may need to introduce measures to control for variation in underlying factors that affect teacher turnover. This could be through subdividing our data, which we model using the proportion of pupils in a school group eligible for free school meals. Alternatively, we might identify comparison sets of school groups working in similar contexts. Another option is to use statistical measures to draw our control limits to mitigate the effects of over dispersion.⁵⁰ Alternatively, given that we know that there are effects which operate at the individual, school and group level it could be to build a multi-level model that predicts expected turnover for each group and looks for those that deviate significantly from it.

In addition to identifying appropriate methods, a remaining challenge is selecting control factors that isolate the effects of workforce management. There is a fairly established set of pupil-level factors that we know has an impact on value-added outcomes for pupils.⁵¹ Similarly, there are several factors which have well established relationships with teacher turnover, such as teacher age and experience, school location and phase. For some of these we have excellent data available, whereas for other crucial factors, such as working conditions, data is hard to obtain. However, whereas schools have limited control over their pupil intake and a key objective of the school system is that all pupils achieve regardless of their background, for workforce management it is less clear what should be considered a 'control' factor and what forms part of a strategic decision by a school group as part of their workforce policies.

For example, we know that teacher experience is a significant predictor of turnover. We also know that local authority schools are less likely than average to employ new entrant classroom teachers, whereas large academy trusts have a relatively high number of new entrant classroom teachers.⁵² We could, within a multi-level model, control for this. However, school groups make their own hiring decisions. Some school groups may make strategic decisions to employ more newly qualified staff and could be understood to accept the risk of higher turnover as a considered pay-off against perceived benefits of having newer staff, such as being able to train them in house or pay lower salaries. Is it therefore correct to 'control out' the effect of staff experience? How would we be able to identify school groups that employ a large number of inexperienced staff as a strategic decision, as opposed to as a result of constrained choice in a time of tight teacher supply? Similarly, school locations are relatively fixed. However, turnover has been found to correlate with local pay gaps, such that smaller gaps between teacher's pay and the local average are linked to higher numbers of more experienced teachers in the workforce and fewer vacant teaching posts.⁵³ Regional disparities in turnover could be understood as a failure of school groups to use pay flexibility to recruit and retain teachers. Given our objective is to isolate group-level organisational practices, it is not straightforward to determine which factors are external to school groups and should be 'controlled

⁵⁰ Spiegelhalter, 'Handling Over-Dispersion of Performance Indicators'; Verburg et al., 'Guidelines on Constructing Funnel Plots for Quality Indicators'.

⁵¹ Leckie and Goldstein, 'The Importance of Adjusting for Pupil Background in School Value-Added Models'.

⁵² Niblett and Andrews, 'People Power: Six Ways To Develop And Retain Educators In Multi-Academy Trusts'.

⁵³ Fullard and Zuccollo, 'Local Pay and Teacher Retention in England'.

out' and which are subject to strategic workforce management decisions and should therefore legitimately be incorporated into measures of organisational performance.

Consultation

Given these uncertainties, we seek the input of the wider sector as how best to construct valid, reliable and meaningful measures of workforce metrics that are useful in identifying school groups with good organisational practices, and those that may raise cause for concern.

We encourage and welcome your feedback in order to improve these measures of efficiency of school groups. Please return your feedback to this address: feedback@epi.org.uk. The closing date for emailing feedback is **Friday 6th January**. Please include some details of which organisation you are representing with your views, for example a university faculty, a school or an academy trust.

Consultation questions

Group membership

Currently, a school which changes groups has a two year 'grace period' during which its turnover figures contribute to neither its old nor new group. Should we attempt to apply a phased transition? For example, turnover during the two-year period could be split between the old and new group? Alternatively, some 'discounting' could be applied to turnover figures in the final year of group membership to take account of 'anticipatory' staff exits?

Group exits

Our definition of an exit differs for different groups (i.e. movement within an LA is counted as exit whereas movement within a MAT is not). Is this the correct approach?

Staff groups

We currently report only teacher turnover. Should we report turnover for other staff groups? If so, should this be through separate measures, combined ones, or both?

If we can prioritise only some additional staff groups, which ones are most important and why?

- School leaders are a crucial determinant of school culture and there are concerns about maintaining sufficient supply. However, their numbers are small so measures may be less reliable, particularly as this group is most likely to move into related roles not captured in the SWC, such as LA and MAT central teams.
- Teaching Assistants work directly with young people, often the most vulnerable pupils. Maintaining long-term relationships might therefore be particularly important for this staff group. However, more teaching assistants have multiple contracts so we will lose more records during the de-duplication process. Teaching assistant turnover may also vary with other factors not currently controlled for, such as the proportion of pupils with ECHPs. For teacher turnover we include special schools within our main analysis. Given the far higher pupil to teaching assistant ratio in special schools, would we need split out special schools if reporting on this staff group?

- Previous research into support staff suggests the majority had not been working in education prior to taking on their current role.⁵⁴ Should it be therefore expected that support staff might move in and out of the education sector more frequently than other staff groups? How should we take account of potential contracting out by some school groups?

Identifying outliers and contextualising turnover

Which factors should be considered as controls that are outside of the purview of group-level workforce management practices, and which should be considered to respond substantially with group-level policies?

How might we measure where this might vary across different school groups in different contexts?

Given the above, which methods are most appropriate for identifying 'outlying' school groups?

Other measures beyond turnover

Beyond turnover, what other measures might be usefully included in measures of workforce management? For example, EPI and the Ambition Institute have previously looked at how quickly staff are promoted within different school groups. We might also look at the proportion of staff working flexibly or look at the progression of different staff groups, such as male or female teachers or teachers from different ethnic backgrounds or qualification routes.

Are there workforce factors we would like to include that are not recorded in the SWC? For example, the proportion of teachers who have achieved NPQs or similar qualifications.

⁵⁴ Whitehorn, 'School Support Staff: Topic Paper'.

Appendices

Appendix A: Random sample

Figure A.A.1: Randomly selected school groups, three year rolling average annual turnover of classroom teachers

Group identifier	Year	Number of teachers (three year total)	Three year rolling average annual turnover of classroom teachers
Diocese 1	2015	2055	16%
Diocese 1	2016	2040	15%
Diocese 1	2017	2035	16%
Diocese 1	2018	2005	15%
Diocese 1	2019	1965	15%
Diocese 2	2015	4360	17%
Diocese 2	2016	3840	17%
Diocese 2	2017	3370	17%
Diocese 2	2018	3020	16%
Diocese 2	2019	2695	16%
Diocese 3	2015	2145	19%
Diocese 3	2016	2115	20%
Diocese 3	2017	1995	18%
Diocese 3	2018	1835	17%
Diocese 3	2019	1605	14%
Established trust 1	2015	290	19%
Established trust 1	2016	315	22%
Established trust 1	2017	310	22%
Established trust 1	2018	315	21%
Established trust 1	2019	310	16%
Established trust 2	2015	165	19%
Established trust 2	2016	255	20%
Established trust 2	2017	255	18%
Established trust 2	2018	250	15%
Established trust 2	2019	240	10%
Established trust 3	2015	250	18%
Established trust 3	2016	400	20%
Established trust 3	2017	455	22%
Established trust 3	2018	495	22%
Established trust 3	2019	540	20%
Federation 1	2015	35	3%
Federation 1	2016	40	0%
Federation 1	2017	40	3%
Federation 1	2018	35	3%
Federation 1	2019	35	3%

Federation 2	2015	25	22%
Federation 2	2016	25	21%
Federation 2	2017	25	19%
Federation 2	2018	25	28%
Federation 2	2019	20	35%
Federation 3	2015	55	23%
Federation 3	2016	55	21%
Federation 3	2017	55	11%
Federation 3	2018	55	11%
Federation 3	2019	55	9%
Foundation trust 1	2015	250	28%
Foundation trust 1	2016	230	24%
Foundation trust 1	2017	220	16%
Foundation trust 1	2018	180	13%
Foundation trust 1	2019	145	12%
Foundation trust 2	2015	365	14%
Foundation trust 2	2016	545	14%
Foundation trust 2	2017	460	13%
Foundation trust 2	2018	375	12%
Foundation trust 2	2019	300	10%
Foundation trust 3	2015	90	11%
Foundation trust 3	2016	175	11%
Foundation trust 3	2017	265	12%
Foundation trust 3	2018	265	11%
Foundation trust 3	2019	275	10%
Local authority 1	2015	3975	15%
Local authority 1	2016	3915	15%
Local authority 1	2017	3830	14%
Local authority 1	2018	3705	13%
Local authority 1	2019	3685	11%
Local authority 2	2015	9780	17%
Local authority 2	2016	8535	16%
Local authority 2	2017	7285	16%
Local authority 2	2018	5885	15%
Local authority 2	2019	4765	13%
Local authority 3	2015	13170	21%
Local authority 3	2016	12335	20%
Local authority 3	2017	11235	20%
Local authority 3	2018	10115	18%
Local authority 3	2019	9390	16%
Diocesan MAT 1	2015	85	13%
Diocesan MAT 1	2016	175	18%
Diocesan MAT 1	2017	260	19%
Diocesan MAT 1	2018	270	21%
Diocesan MAT 1	2019	265	16%

Diocesan MAT 2	2015	20	25%
Diocesan MAT 2	2016	180	25%
Diocesan MAT 2	2017	400	21%
Diocesan MAT 2	2018	640	20%
Diocesan MAT 2	2019	730	15%
Diocesan MAT 3	2015	105	11%
Diocesan MAT 3	2016	210	11%
Diocesan MAT 3	2017	315	10%
Diocesan MAT 3	2018	315	11%
Diocesan MAT 3	2019	310	9%
National trust 1	2015	95	10%
National trust 1	2016	260	17%
National trust 1	2017	415	19%
National trust 1	2018	460	22%
National trust 1	2019	575	21%
National trust 2	2015	45	11%
National trust 2	2016	275	16%
National trust 2	2017	520	15%
National trust 2	2018	805	15%
National trust 2	2019	905	13%
National trust 3	2015	305	20%
National trust 3	2016	500	18%
National trust 3	2017	555	18%
National trust 3	2018	635	17%
National trust 3	2019	875	18%
SAT 1	2015	80	18%
SAT 1	2016	80	16%
SAT 1	2017	80	12%
SAT 1	2018	75	12%
SAT 1	2019	75	5%
SAT 2	2015	340	24%
SAT 2	2016	315	25%
SAT 2	2017	295	21%
SAT 2	2018	280	20%
SAT 2	2019	270	15%
SAT 3	2015	10	27%
SAT 3	2016	15	20%
SAT 3	2017	15	7%
SAT 3	2018	15	0%
SAT 3	2019	15	0%
Starter trust 1	2015	40	26%
Starter trust 1	2016	80	27%
Starter trust 1	2017	115	21%
Starter trust 1	2018	110	16%
Starter trust 1	2019	110	9%

Starter trust 2	2015	10	17%
Starter trust 2	2016	25	26%
Starter trust 2	2017	30	19%
Starter trust 2	2018	30	20%
Starter trust 2	2019	30	14%
Starter trust 3	2015	15	29%
Starter trust 3	2016	25	19%
Starter trust 3	2017	45	18%
Starter trust 3	2018	45	11%
Starter trust 3	2019	50	10%
System trust 1	2015	4100	24%
System trust 1	2016	4945	24%
System trust 1	2017	4785	22%
System trust 1	2018	4635	20%
System trust 1	2019	4450	19%
System trust 2	2015	1610	42%
System trust 2	2016	1770	44%
System trust 2	2017	1615	32%
System trust 2	2018	1755	34%
System trust 2	2019	1790	27%
System trust 3	2015	2090	21%
System trust 3	2016	2425	21%
System trust 3	2017	2495	21%
System trust 3	2018	2375	20%
System trust 3	2019	2305	18%

Appendix B: Drawing control limits

We calculate the overall five-year cumulative turnover rate by looking at the proportion of teachers who are no longer in their group five years after the baseline year and dividing this by the total number of teacher records. We use data only for the schools that are included in our five-year cumulative turnover figures.

We then calculate the standard error of the mean (also known as the standard deviation of the sampling distribution) for each available value of n using the formula:

$$\sigma_m = \sqrt{\frac{p'(1 - p')}{n}}$$

Where:

σ_m = standard error of the mean

p' = overall 5-year cumulative turnover

n = number of teacher records

So, for a school group with 2000 teachers in a sample with an overall exit rate of 49 per cent the value would be:

$$\sigma_m = \sqrt{\frac{0.49(1 - 0.49)}{2000}} = 1.24 \times 10^{-5}$$

We then calculate the confidence interval for using the equation

$$CI = p' \pm \left[Z_{\frac{\alpha}{2}} \sigma_m \right]$$

where $Z_{\frac{\alpha}{2}}$ is set depending on the desired confidence interval. Our funnel plots use a 95 and 99.7 per cent CI so that $Z_{\frac{\alpha}{2}}$ resolves to 1.96 and 3. In other words, we calculate our confidence intervals by multiplying the standard error of the mean by 1.96 (for the 95 per cent confidence interval) or 3 (for the 99.7 confidence interval) and then adding or subtracting this from our calculated overall five-year cumulative turnover rate.

The calculated values are then plotted and a smoothed curve joining them is created using the LOESS smoothing method in the `geom_smooth` function in `ggplot` in R.

Appendix C: Matching FSM data

Our downloaded establishment data contains records for 48,760 educational establishments. We remove 392 located outside of the UK. Of the remaining 48,368, 26,548 are listed as open, 21,696 listed as closed, 64 as open, but proposed to close and 60 as proposed to open. We initially retain all records regardless of open/closed status to increase the chances of matching data to the 24,947 schools in our group membership database for 2020.

We match our 2020 group membership data to the contextual information by URN. 121 records in our group membership database have no match in the GIAS download. Of these, 89 are not open on 05/11/2020, 29 offer service children's education only, two are post-16 institutions and one is a VS infant school. However, an additional 1505 records have missing data for either pupil count or school FSM share.

Manual inspection of NA values for either pupil count or FSM share revealed that some schools in our group membership database had updated URNs which were not yet present in the GIAS download. We were able to find complete data for 460 of these schools by matching their predecessor URN to the GIAS download.

For the remaining missing values, we searched an additional GIAS download taken from 01/09/2021 to see if data was available for the next academic year. This yielded complete data for an additional 61 schools.

After matching, we removed 134 schools marked as closed in the GIAS download, alongside establishments marked as 'Other independent school', 'Other independent special school' or 'Local authority nursery school'. Following this, 530 records still had either no pupil count or no FSM share. A summary of the types of school this represents is presented in Figure A.C.1

Figure A.C.1: Summary of data loss during contextual data matching process

Processing step	Records remaining
Initially in group database	24,947
Matched to GIAS download	24,826
Have a pupil count and FSM share in GIAS download	23,321
Matched using either 2020 URN or 2019 URN	23,781
Matched using either 2020 URN or 2019 URN and 2020 or 2021 data	23,842
After closed, independent and nursery schools are removed	22,153
After schools still missing pupil counts or FSM share removed	21,623

Figure A.C.2: Summary of groups with no group-level FSM data

Group Type	N
Academy 16-19 converter	28
Academy alternative provision converter	4
Academy converter	1
Free schools	3
Free schools 16 to 19	8

Free schools alternative provision	3
Further education	239
Miscellaneous	80
Pupil referral unit	5
Secure units	17
Sixth form centres	16
Special post 16 institution	126
Sum	530

Appendix D: Funnel plots by FSM share

Figure A.D.1: Number of groups of each type lying outside control limits for five-year cumulative turnover, low FSM groups (2015 baseline, groups with more than 100 teacher records only)

Group Type	Total in data	Above control limit				Below control limit			
		95%		99.7%*		95%		99.7%*	
		n	%	n	%	n	%	n	%
Established Trust	5	2	40%	0	0%	2	40%	0	0%
National Trust	2	1	50%	0	0%	0	0%	0	0%
Diocese MAT	2	0	0%	0	0%	0	0%	0	0%
Diocese	3	1	33%	1	33%	0	0%	0	0%
LA	1	1	100%	1	100%	0	0%	0	0%
SAT	28	5	18%	1	4%	4	14%	2	7%
Total	41	10	24%	3	7%	6	15%	2	5%

Figure A.D.2: Number of groups of each type lying outside control limits for five-year cumulative turnover, low-medium FSM groups (2015 baseline, groups with more than 100 teacher records only)

Group Type	Total in data	Above control limit				Below control limit			
		95%		99.7%*		95%		99.7%*	
		n	%	n	%	n	%	n	%
Established Trust	17	2	12%	2	12%	4	24%	3	18%
National Trust	10	1	10%	1	10%	2	20%	0	0%
Diocese MAT	4	3	75%	1	25%	0	0%	0	0%
Diocese	6	0	0%	0	0%	0	0%	0	0%
Foundation Trust	33	9	27%	6	18%	11	33%	6	18%
LA	1	0	0%	0	0%	1	100%	1	100%
SAT	36	13	36%	9	25%	11	31%	8	22%
Total	19	1	5%	1	5%	3	16%	3	16%

Figure A.D.3: Number of groups of each type lying outside control limits for five-year cumulative turnover, medium-high FSM groups (2015 baseline, groups with more than 100 teacher records only)

Group Type	Total in data	Above control limit				Below control limit			
		95%		99.7%*		95%		99.7%*	
		n	%	n	%	n	%	n	%
Established Trust	17	2	12%	2	12%	4	24%	3	18%
National Trust	10	1	10%	1	10%	2	20%	0	0%
System Trust	4	3	75%	1	25%	0	0%	0	0%
Diocese MAT	6	0	0%	0	0%	0	0%	0	0%
Diocese									
Federation	33	9	27%	6	18%	11	33%	6	18%
Foundation Trust	1	0	0%	0	0%	1	100%	1	100%
LA	36	13	36%	9	25%	11	31%	8	22%
SAT	19	1	5%	1	5%	3	16%	3	16%
Total									

Figure A.D.4: Number of groups of each type lying outside control limits for five-year cumulative turnover, high FSM groups (2015 baseline, groups with more than 100 teacher records only)

Group Type	Total in data	Above control limit				Below control limit			
		95%		99.7%*		95%		99.7%*	
		n	%	n	%	n	%	n	%
Established Trust	14	5	36%	4	29%	1	7%	1	7%
National Trust	24	9	38%	7	29%	4	17%	0	0%
System Trust	5	3	60%	3	60%	1	20%	0	0%
Diocese	7	2	29%	0	0%	2	29%	1	14%
Federation	18	4	22%	4	22%	10	56%	6	33%
Foundation Trust	1	1	100%	1	100%	0	0%	0	0%
LA	3	1	33%	0	0%	1	33%	1	33%
SAT	67	16	24%	16	24%	30	45%	20	30%
Total	18	3	17%	2	11%	5	28%	2	11%